CORRELATION BETWEEN TECHNOLOGICAL CREATIVITY, SELF EFFICACY AND KNOWLEDGE SHARING AMONG ATHLETES

Chao-Sen, Wu, TransWorld University, Taiwan
Li-Fen Tsai, TransWorld University, Taiwan
Pei-Wen Wang, TransWorld University, Taiwan

ABSTRACT

The main purposes of this study were to investigate the influence of technological creativity for sports, self-efficacy and knowledge sharing , and to analyze the correlation between technological creativity for sports and knowledge sharing, via the mediating effect of athletes' self-efficacy. This study selected current athletes, including tennis players, track and field athletes, volleyball players, etc. as the subjects, with a total of 250 athletes. Statistical methods, such as Cronbach's α, factor analysis, Pearson's correlation, regression analysis, and path analysis, were used to perform analyses. It was found that on the technological creativity for sports , athletes' creativity and technological capacity had significant positive influence for self-efficacy. In other words, the improvement in athletes' self-efficacy may improve their creativity and level of technological capacity. Therefore, it is necessary for coaches to constantly strengthen athletes' self-efficacy and provide them with the space for the development of creativity and technological capacity in order to specifically improve their athletic performance.

JEL: M12

KEYWORDS: Knowledge Sharing , Self-efficacy, Technological Creativity for Sports

INTRODUCTION

Current scientific training processes enable athletes to discover their physical limitations and provide them with almost complete technological training that approach the matured state of technological skills, which strengthens and develops their potential and is regarded as training in the psychological aspect (Lin,2007). Weinberg (1995) indicated that in both individualized and group sports competitions, the competitors' psychological state has a 90% of chance of affecting the results of the competition. Therefore, relevant studies on psychological skills have become one of the focuses of sports psychologists, coaches, and athletes. Many scholars suggested that athletes' performance in a sports competition no longer simply involved the frequency of physical training, but also the psychological traits in a competition or during the training (Kellner,1989;Chi,1995;Lin,2007).

Karlqvist (1997) suggested that creativity is a capacity for creation. Tierney, Farmer & Grean (1999) indicated that creativity is the pursuit of utility, uniqueness, and results. What is "technological creativity?" Chiu and Yeh (1998) suggested that technological creativity is the successful fulfillment of creative technology. Technological creativity is also the integration of domain knowledge with the process of the formation of creative thought, and the results of formative and creative thinking. As for the athlete-centered field of athletic sports, the emphasis is on the connection of technological creativity for sports with athletes' course of creation of value, which is one of the main purposes of this study.

Among the performance indicators, which were used to assess athletes' individual performance in the past, the aspect of technological creativity for sports was seldom mentioned. However, with the continuous progress in athletes' capacities, diversified training models have become the current training trend, they require to cover more diversified levels. Better creativity and ideas can be proposed based on the athletes' technological creativity for sports, as well as the sharing of relevant knowledge and honor. It can be inferred that the importance of the use of technological creativity for sports to understand athletes' performance in competitions cannot be ignored.

The structure of this research included literature review of keywords, collected data , research method, results and concluding comments. This study analyzed the influence of technological creativity for sports on self-efficacy and knowledge sharing, and further investigated the correlations between technological creativity for sports and knowledge sharing via the mediating effect of athletes' self-efficacy.

LITERATURE REVIEW

SELF-EFFICACY : Bandura (1977) indicated that self-efficacy refers to an individual's level of self confidence in their capacity to complete a specific work by himself/herself. Bandura (1991) suggested that an individuals' faith in their own performance will affect the choices they make, their aspirations, devotion to specific tasks, and how long they can pursue specific goals when faced with difficulties and setbacks. This study suggested that self-efficacy is the judgment of self-capacity to complete specific tasks by individuals. The individuals with higher self-efficacy have higher confidence in accepting challenges. On the contrary, the individuals with lower self-efficacy usually suggest that it is difficult for them to face different challenges. Some studies have found that self-efficacy can improve athletes' athletic performance. In addition, it has been proved that outstanding athletes will use self-efficacy to improve their technologies (Lee,1988; Feltz,1988; Martin & Gill,1991).

Technological Creativity for Sports

Creativity is the thinking process where creativity is activated and triggered (Majaro , 1988). Amabile (1988) suggested that the major factors triggering creativity are profession, creativity thinking skills, intrinsic motivation of work, and social contexts. Amabile (1995) further proposed that creativity is comprised of the new thoughts or matter developed through different human behavioral activities. Runco (2000) suggested that creativity is the expression of adaptability, and is an integrative application of experience transformation, individual subjective consciousness, motivations, knowledge, and experiences. Yeh (2000) suggested that creativity is the course of the development of innovative and valuable products by individuals in specific fields, and such course involves the integration and effective application of cognition, affections, and skills. Wu (2007) proposed a model for the assessment of technological creativity for sports based on three aspects, namely, "cognition", "affection", and "skills". This study applied technological creativity to athletes in their professional sports aspects to create appropriate, innovative, and practical technologies; such process is referred to as technological creativity for sports.

This study suggested that there was a strong correlation among technological creativity for sports, athletes' individual and accumulated knowledge capacity and environment; where athletes must possess the various skills of sports-related fields and creativity-related competencies and motivations.

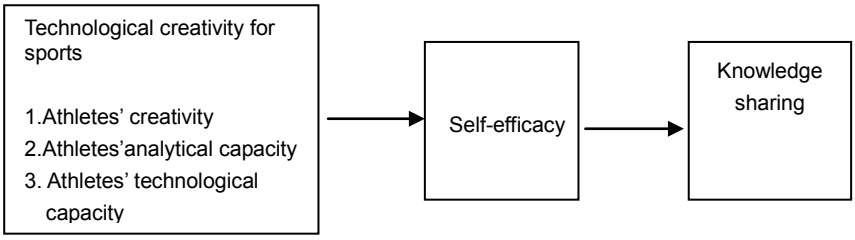
Knowledge Sharing

Sternberg and Lubart (1999) suggested that creativity requires the support of knowledge. Knowledge can be divided as formal and informal knowledge. Knowledge is a complex flow property, which can be used to guide human thinking, behaviors, and communication (van der Spek and Spijkervet, 1997). Beckman (1999) suggested that knowledge is a kind of human logical reasoning for data and information, which can improve human performance at work, in decision-making, problem-solving, and learning; and therefore, innovation and creativity requires new knowledge (Afuah, 1998). Creativity itself is the result of knowledge creation (Wang, 2010). Nonaka & Takeuchi (1995) suggested that knowledge sharing is the process of mutual interactions between implicit knowledge and explicit knowledge. The interaction of different knowledge results in the development of knowledge innovation. Senge (1998) suggested that knowledge is a kind of capacity for effective actions, which is obtained thorough learning, and its purpose is to assist in learning and expand the capacity for effective actions. Nancy (2000) proposed the concept of "sharing" and suggested that sharing is awareness, which is the conveyance of information or knowledge owned by individuals to others, which enables others to possess the same information and knowledge.

DATA AND METHODOLGY

The research framework was established based on the aforementioned research motivations, purposes, and literature reviews. In addition, the data were collected by conducting a questionnaire survey to test whether the hypotheses were supported. The explanations regarding the research framework, research hypotheses, research subjects, and assessment of research variables are described as follows:
The overall conceptual framework is shown in Figure 1. In Figure 1, "-->" denoted the direction of influence. As shown in Figure 1, technological creativity for sports has an influence on both knowledge sharing and self-efficacy. In addition, self-efficacy was used as the mediating variable to analyze the correlations among technological creativity for sports and knowledge sharing.

Figure 1: Research Framework



Note:1. Technological creativity for sports has an influence on both knowledge sharing and self-efficacy. 2.Self-efficacy was used as the mediating variable to analyze the correlations among technological creativity for sports and Knowledge sharing.

Based on literature and the inferences above, the hypotheses of this study were set as follows:

H1: Technological creativity for sports has a significant influence on knowledge sharing.

H2: Technological creativity for sports has a significant influence on self-efficacy.

H3: Technological creativity for sports has a significant influence on knowledge sharing via the mediating effect of self-efficacy.

Assessment of Research Variables

This study referred to relevant literature to choose each research aspect, define variables, and conduct the questionnaire survey to conform to the original research purposes and descriptions acceptable for the subjects. Five physical education (PE) teachers were invited to discuss and amend the questionnaire content to further draw the formal questionnaire. The questionnaire survey was then conducted on 20 athletes to verify the feasibility of the questionnaire. In terms of the questionnaire design, in addition to the individual basic information, a 7-point Likert scale was employed for the assessment of other questions in the questionnaire. The variables were assessed based on the scale ranging from "strongly disagree (1 point)" to "Strongly agree" (7 points). The variables are as follows. Technological creativity for sports: This study referred to the technological creativity scale used by Torrance (1966), Lin and Wang (1994), and Hung (1999) to assess athletes' level of agreement on technological creativity for sports. Regarding self-efficacy: This study referred to the self-efficacy scale for particularities used by Chen, Gully & Eden (2001) to develop the questions. A total of eight assessment questions were developed in order to understand athletes' assessment of self-capacity. Regarding knowledge sharing: This study referred to the knowledge sharing scale used by Nelson & Cooprider (1996), and Senge (1998) to assess the level of mutual knowledge sharing among athletes. A total of eight assessment questions were developed, including the mutual knowledge sharing among athletes and overall sports team knowledge sharing.

RESULTS

This study conducted a questionnaire survey on 250 athletes, with 176 male subjects (70.4%) and 74 female subjects (29.6%). Among them, 153 of the subjects were aged 26-30 (61.2%). Regarding educational background, most were college graduates, including 105 subjects (85.6%). Regarding the years of training and competition participation, 1-3 years was the majority for years of training and competition participation, a total of 170 subjects (68%). Regarding sports categories, the top three sports were tennis, 79 subjects (31.6%), track and field, 51 subjects (20.4%), and volleyball, 49 subjects (19.6%). This study used the Largest Variation Axis of Factor Analysis to obtain the factors with an Eignenvalue > 1, and deleted those questions with low factor loading. In terms of the scale for technological creativity for sports, a total of three factors were extracted, and the cumulative amount of variation explained was 76.78%. Factor 1 was associated with the creative thoughts and innovative thinking of athletes, and was named "athletes' creativity". Factor 2 was associated with analysis, problem-solving, and challenges, and thus was called "athletes' analytical capacity". Factor 3 was associated with self-challenge and technological innovation, and thus was called "athletes' technological capacity".

Cronbach's α of these three aspects were 0.94, 0.91, and 0.91, respectively. In regard to the self-efficacy scale, one factor was extracted, were the cumulative amount of variation explained was 64.83%, and because the factor was associated with athletes' self-efficacy, it was called "self-efficacy". Cronbach's α of the aspect of self-efficacy was 0.91. Regarding the knowledge sharing scale, one factor was extracted, and the cumulative amount of variation explained was 70.28%, and because the factor was associated with knowledge sharing among athletes, it was called "knowledge sharing". Cronbach's α of the aspect of knowledge sharing was 0.93. Cronbach's α for each factor aspect in this study was greater than 0.80, suggesting that the scale had high reliability. The factor aspects extracted based on factor analysis were consistent with the original design of this study, suggesting that the scale had appropriate construct validity. According to the correlation analysis in Table 1, there was a positive correlation between "athletes' creativity" and "athletes' technological capacity" for self-efficacy. In other words, the better athletes' "creativity" and "technological capacity" were, the better their "self-efficacy".

Table 1: Table of Pearson Correlation Analysis

Research variables	Means	Standard deviation	1	2	3	4	5
1.Athletes' creativity	5.55	0.94	1.00				
2.Athletes'analytical capacity	5.87	0.67	-.06	1.00			
3.Athletes' technological capacity	5.60	0.91	.39**	-.09	1.00		
4.Self-efficacy	4.60	0.86	.68**	-.15**	.45**	1.00	
5.Knowledge-sharing	5.36	0.87	-.07	-.04	-.04	-.07	1.00

*Note: 1.**denotes p <0.012. The research used Means to understand athletes' condition , higher Means meant the subjects of this study had higher identification for the research dimension. Therefore , the Means value of athletes' creativity, analytical capacity, and knowledge sharing were higher 5, it meant the identifications of these dimensions were generally higher. 3. The Means of self-efficacy was lower than 5, it meant the identification was lower.*

In order to understand the correlation among athletes' technological capacity for sports self-efficacy and knowledge sharing, and regression analysis was conducted, where self-efficacy and knowledge sharing were used as criterion variables. And athletes' creativity, analytical capacity, and technological capacity were used as predictor variables.

The regression equations were following:

Model 1: Self-efficacy = 1.75+0.68 (athletes' creativity)

Model 2: Self-efficacy = 6.46-0.14 (athletes' analytical capacity)

Model 3: Self-efficacy = 3.08+0.45 (athletes' technological capacity)

Model 4: Knowledge sharing = 4.96 - 0.07 (athletes' creativity)

Model 5: Knowledge sharing = 4.87 - 0.04 (athletes' analytical capacity)

Model 6: Knowledge sharing = 4.81-0.41 (athletes' technological capacity)

It was found in the results of regression analysis that athletes' knowledge sharing had a significant influence on athletes' creativity, analytical capacity and technological capacity of technological creativity for sports (β values were 0.68, -0.14,and 0.45),suggesting that there was a linear relationship, as shown in models 1,2, and 3.(see Table 2)

Table 2: Regression Analysis on Technological Creativity for Sports, Knowledge Sharing, and Self Efficacy

Criterion variables / **Predictor variables**	**Self-efficacy**			**Knowledge sharing**		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
constant term	1.75	6.46	3.08	4.96	4.87	4.81
Athletes'creativity	0.68**			-0.07		
Athletes'analytical capacity		-0.14 +			-0.04	
Athletes' technological capacity			0.45**			-0.41
F value	208.98**	5.24 +	61.73**	1.10	0.30	0.42
R^2	0.457	0.021	0.199	0.004	0.001	0.002

*Note: 1. + denotes p<0.1, ** denotes p<0.01 2. Model 1：y1=1.75+0.68x1, Model 2：y2=6.46-0.14x2, Model 3：y3=3.08+0.45x3 ; The p-value of Model 1,2,3 were lower 0.1, it had significant influence. 3. Model 4：y4=4.96-0.07x4, Model 5：y5=4.87-0.04x5, Model 6：y6=4.81-0.41x6 ; The p- value of Model 4,5,6 were higher 0.1, it had no significant influence.*

According to the vertification of mediating effects proposed by Baron & Kenny(1986),the criteria are as follows: First, the predictor variable has significant influence on the mediating variable. Finally, after the mediator is included, the correlation between the predictor variable and criterion variable should be weaker than before it is inclusive. The correlation in Table 1 indicates that there was no correlation between athletes' creativity, analytical capacity, technological capacity and self-efficacy, and there was not significant correlation between knowledge and self-efficacy, which met the former two criteria proposed by Baron & Kenny, but the second item of this research didn't follow the term. Therefore, the research obtained that athletes' self-efficacy didn't have mediating effect on the correlation among athletes' creativity, analytical capacity, technological capacity, and self-efficacy.

The purposes of this research were to investigate the influence of technological creativity for sports, self-efficacy and knowledge sharing , and to analyze the correlation between technological creativity for sports and knowledge sharing, via the mediating effect of athletes' self-efficacy. This study selected current athletes as the subjects, with a total of 250 athletes. Statistical methods were used to perform analyses, such as Cronbach's α, factor analysis, Pearson's correlation, regression analysis, and path analysis.

It was found that athletes' creativity, technological capacity and analytical capacity in athletes' technological creativity had a positive influence on self-efficacy. The improvement in athletes'

creativity and technological capacity had direct significant influence on athletes' self-efficacy, which was one of the major causes for a significant improvement in athletes' technological creativity. Such results can be provided as references to future training. In addition, athletes' analytical capacity had significant negative influence on self-efficacy, it meant athletes' analytic capacity would reduce the athletes' self-efficacy. And athletes' analytic capacity had no influence on knowledge sharing, it meant that high or low athletes' technological creativity had no influence on knowledge sharing.

The results indicated that there was no significant influence on athletes' technological creativity and knowledge sharing via the mediating variables of self-efficacy. That is, the advancement of athletes' self-efficacy had no assistance for athletes' technological creativity on the influence of knowledge sharing.

CONCLUDING COMMENTS

Technological creativity is the successful fulfillment of creative technology. With effective cultivation and training of creativity and technological capacity, better performance can be obtained. In other words, when athletes constantly try new methods, approaches, and skills, coaches should provide them with guidance or assistance at the right time in order to trigger new ideas and achieve the expected objectives.

To strengthen athletes' self-efficacy, as well as to improve athletes' creativity and technological capacity, athletes' performance can be further increased. Therefore, it is necessary for coaches to constantly strengthen athletes' self-efficacy during training and provide them with the space for the development of creativity and technological capacity. In this way, athletes' specific athletic performances can be improved. Regarding the subjects of questionnaire survey, this study adopted convenience sampling, thus, demographic variables were not upon average distribution. Future studies can adopt stratified sampling. The athletes who fill in the questionnaire might be influenced by subjective or external factors such as environment, emotion, attitude and perception.

This study used path analysis to verify the research hypotheses. Structural Equation Model (SEM) can be included to verify models in future studies. Because there is a lack of relevant studies on technological creativity for sports, it is hoped that these research results can be provided as references for future studies to continuously clarify and investigate technological creativity in sports.

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BIOGRAPHY

Chao-Sen Wu, Department of Business Administration, Transworld University, Taiwan. Contacted address: No.1221, Zhennan Rd., Douliu City, Yunlin County 640, Taiwan.
Email: jausen1980@yahoo.com.tw

Li-Fen Tsai, corresponding author, Department of Marketing Management, Transworld University, Taiwan. Contacted address:No.1221, Zhennan Rd., Douliu City, Yunlin County 640, Taiwan
Email: lifen824@yahoo.com.tw

Pei-Wen Wang, Department of Marketing Management, Transworld University, Taiwan. Contacted address: No.1221, Zhennan Rd., Douliu City, Yunlin County 640, Taiwan.
Email: peiwenwang@twu.edu.tw