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Multiple Intelligences Development of Athletes: Examination on Dominant Intelligences

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Abstract**—**The study attempted to identify the dominant intelligences of athletes by comparing the developmental differences of multiple intelligences between athletes and non-athletes. The weekly specialized training hours and years of specialized training was examined to see how it can predict the dominant intelligence with the age factor controlled. There were 355 participants in the research (202 athletes and 153 non-athletes). Collected data were analyzed with one-way MANOVA and multiple hierarchical regression. The results suggested the dominant intelligences of athletes were Interpersonal Intelligence, Bodily-Kinesthetic Intelligence, and Intrapersonal Intelligence. The weekly specialized training hours and years of specialized training could effectively predict the Interpersonal Intelligence, Bodily-Kinesthetic Intelligence, and Intrapersonal Intelligence of athletes. The author suggested the future studies could focus on the theory construction of weekly specialized training and years of specialized training. Also, the studies on using "Bridge strategy" by the athletes to guide disadvantage intelligences with dominant intelligences are highly valued.

Keywords**—**non-athletes, academic achievement, Multiple Intelligences Theory

I. Introduction

ACCORDING to existing literatures, athletes were different from non-athletes on many aspects, such as academic development, characters, social adoptability, mobile reaction, balancing, visual capability, attention, and intrapersonal development[1-4]. Although previous studies had covered multiple aspects, most of them were merely discussing single or partial factors. Indeed, in-depth analysis on single or partial aspects would benefit broadening relevant knowledge, yet comprehensive studies on this domain shouldn't have been overlooked. In order to expand the width of the studies while considering the entity of knowledge, the present study utilized a diverse and grand theory and attempted to identity the difference between athletes and non-athletes.

Athletes always gave the impression of all brawn no brains and such impression should be corrected [5]. Pérez, Beltramino and Cupani [6] developed the scale of multiple intelligences, they believed such scale could be used as the tool of measuring whether athletes had highly-developed intelligences other than Bodily-Kinesthetic Intelligence. The results of present study would be able to respond to the question for long by identifying the differences between athletes and non-athletes through wide and credible theory. In addition, the eight intelligences had crossed a large scope therefore the results could also be used as the reference for coaching the comprehensive development of athletes in the future. As the previous research on "bridge strategy" – by using dominant intelligence of music to direct the disadvantage intelligence of linguistics of aboriginal students by Liu [7]. If such pattern could be used on athletes, there should be both high academic and practical values. The results of exploring the differences between athletes and non-athletes could also be the baseline for the bridge strategy of athletes in the future.The differences between athletes and non-athletes are definitely not merely on the physics, the intelligent, psychological, and social aspects were also involved. It would be too limited if only consider the Primary Mental Ability Theory by Thurstone or the Structure of Intellect Theory by Guilford. The multiple intelligences theory by [8] divided intelligences into Linguistic, Logical-Mathematical, Spatial, Bodily-Kinesthetic, Musical, Interpersonal e, Intrapersonal, and Naturalist Intelligence. The components of these eight intelligences were as follows: Linguistic Intelligence: grammar utilization, linguistic structure, pronunciation, and vocabulary; Logical-Mathematical Intelligence: classification, deduction, calculation, hypothesize, and authentication; Spatial Intelligence: color, line, shape, and distance; Bodily-Kinesthetic Intelligence: coordination, agility, strength, speed, and energy; Musical Intelligence: scale, melody, and rhythm; Interpersonal Intelligence: awareness, recognition, comprehension, and reaction; Intrapersonal Intelligence: self-regulation, self-consciousness, adjustment, and emotional control; and Naturalist Intelligence: observation, discrimination, and categorization [9]. These eight intelligences traversed all kinds of meaningful abilities of human beings which also break away from the traditional framework of intelligence. In addition, the Multiple Intelligences Theory was the broadest and most credible one among all the theories regarding human intelligent development [8-9]. Therefore, it was most appropriate to adopt the Multiple Intelligences Theory as the foundation while making the broad and objective exploration on the differences between athletes and non-athletes.Previous researches

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suggested athletes had better performances on self-examination, self-judgement, sport friendship, team cohesion, mobile reaction, kinematics, visual ability, and spatial concept [10-14]. Therefore, it was hypothesized that the Intrapersonal Intelligence, Interpersonal Intelligence, Bodily-kinesthetic Intelligence, and Spatial Intelligence would be superior to non-athletes in present study. Furthermore, the author also attempted to examine the Linguistic Intelligence, Logical-Mathematics Intelligence, Musical Intelligence, Naturalist Intelligence to explore whether there were differences between athletes and non-athletes on these aspects. After identifying the differences of Multiple Intelligences Development between athletes and non-athletes, we were able to confirm the dominant intelligences of athletes. In addition, present study also referred to the suggestions by Sherlock [15] and investigated whether the years of specialized training and weekly hours of specialized training could predict the development of dominant intelligences of athletes. Due to the naturally maturing effect of Multiple Intelligences Developments of individuals [16-18], present study had set the age as the control variable so that the predictability of years of specialized training and weekly hours of specialized training could be measured more accurately.

II. Methods

A. Participants

Present study sampled from 6 high schools and eight universities in Taiwan. The samples of athletes were the members of sports teams of schools; samples of non-athletes were those who never received specialized sports trainings and were without the membership of sports teams. Total of 426 questionnaires were administrated and 355 effective ones were collected, the effective rate was 83.33%. The average age of participants was 19.28. 58.59% of the participants were male (n=208) and 41.41% were female (n=147). 56.90% of the participants were athlete (n=202) and 43.10% were non-athletes (n=153). 25.35% of participants were high school athletes (n=90); 28.45% were high school non-athletes. 31.55% of the participants were college athletes (n=112); 23.10% were college non-athletes (n=82).

B. Measurement

Pérez, Beltramino and Cupani [6] developed the Scale of Multiple Intelligences and the authors modified a Chinese version of the scale which had acceptable reliability and validity. The examples of items in the scale included, "have composed formal article or essay" in the sub-scale of Linguistic Intelligence; "interpreting the survey" in the sub-scale of Logical-Mathematic Intelligence; and "understanding one's strengths and weaknesses in different situations" in the sub-scale of Intrapersonal Intelligence. 10-point Likert scale was used, the respondents rated the item from 1 to 10 (10 as 'very much;' 1 as 'not at all'). The scale was tested with confirmatory factor analysis with acceptable validity. In addition, the α coefficients of each sub-scales were over .90 which showed ideal internal consistency. Furthermore, present study inquired the background of respondents with singular items, which included the years involved in specialized sport training and weekly training hours. The foreword had indicated the anonymity of the questionnaire which would only be used academically so that respondents could feel comfortable filling the answers.

C. Processing and analysis

The authors personally administrated and retrieved the questionnaires. The responding environment was stress-less and with no interference. After the questionnaires were retrieved, the null ones were eliminated. Data collected were analyzed by SPSS for Windows17.0. The first step was examining the differences of Multiple Intelligences Developments between athletes and non-athletes by one-way MANOVA; the second step was examining the predictability of years of specialized training and weekly specialized training hours on the dominant intelligences of athletes through multiple hierarchical regression. The significant level was set as $\alpha = .05$.

III. Results

A. The differences of Multiple Intelligences Development between Athletes and non-athletes

Generally, the results suggested there were significant differences of the Multiple Intelligences Developments between athletes and non-athletes (Wilk's $\lambda = .548$, $p < .001$). As the hypothesis, athletes had higher Interpersonal Intelligence, Bodily-kinesthetic Intelligence, and Intrapersonal Intelligence than non-athletes and the differences on Bodily-kinesthetic Intelligence were most significant. However, what contrary to the hypothesis of present study was that no notable differences on Spatial Intelligence. In addition, there were no remarkable differences on the Musical and Naturalist Intelligences between athletes and non-athletes either; while non-athletes had higher Linguistic and Logical-Mathematic Intelligences than athletes. The data were demonstrated in TABLE I.

TABLE I
MULTIVARIATE STATISTICAL ANALYSIS ON THE DIFFERENCES OF MULTIPLE INTELLIGENCES DEVELOPMENTS

Variables	SS	F	Eta sq	Differences
Interpersonal	21.17	22.01*	.072	Athletes >Non-athletes
Bodily	346.43	215.1*	.408	Athletes >Non-athletes
Intrapersonal	6.24	7.66*	.025	Athletes >Non-athletes
Spatial	2.52	2.56	.006	None
Musical	.37	.37	.001	None
Naturalist	.41	.26	.001	None
Linguistic	9.12	7.45*	.022	Athletes < Non-athletes
Logical-Math	7.52	5.55*	.016	Athletes < Non-athletes

*p < .05

B. The predictability of years of specialized training and weekly hours of specialized training on dominant intelligences of athletes

Pervious examinations showed that the dominant intelligences were inter-personal, Bodily-kinesthetic, and Intrapersonal Intelligences. Therefore, the next phase was to

examine how years of specialized training and weekly specialized training hours of athletes could predict their Multiple Intelligences development through multiple hierarchical regression.Interpersonal Intelligence: After entering the control variable – age in model 1, the F value had reached significant level and so did t value, which suggested age contributed to the prediction of Interpersonal Intelligence. After entering the variable of years of specialized training and weekly specialized training hours in model 2, the F value had reached significant level and so did t values of both years of training and weekly training hours, which suggested years of specialized training and weekly specialized training hours contributed to the prediction of Interpersonal Intelligence. Therefore, after controlling the age variable, years of specialized training and weekly specialized training hours could predict the development of athletes' Interpersonal Intelligence as shown in TABLE II.

TABLE II
REGRESSION ANALYSIS OF INTERPERSONAL INTELLIGENCE

	Model 1		Model 2	
	β	t	β	t
Age	.18	2.82*	.07	1.19
Years			.27	4.47*
Weekly hours			.34	5.62*
R2%		2.70		26.60
F		7.96*		31.63*
ΔR2%		2.70		23.90
ΔF		7.96*		42.17*

*p< .05

Bodily-kinesthetic Intelligence: After entering the control variable – age in model 1, the F value had reached significant level and so did t value, which suggested age contributed to the prediction of Bodily-kinesthetic Intelligence. After entering the variable of years of specialized training and weekly specialized training hours in model 2, only the t value of weekly hours reached the significant level and the R square increased by 7.4%, which suggested weekly hours contributed to the prediction of Bodily-kinesthetic Intelligence. Therefore, after controlling the age variable, weekly specialized training hours could predict the development of athletes' Bodily-kinesthetic Intelligence as shown in TABLE III.

TABLE III
REGRESSION ANALYSIS OF BODILY-KINESTHETIC INTELLIGENCE

	Model 1		Model 2	
	β	t		β
Age	.12	1.98*	.07	1.19
Years			.07	1.05
Weekly Hours			.17	2.52*
R2%		1.50		8.90
F		3.90*		8.12*
ΔR2%		1.50		7.40
ΔF		3.90*		10.08*

*p< .05

Intrapersonal Intelligence: After entering the control variable – age in model 1, the F value had reached significant level and so did t value, which suggested age contributed to the prediction of Intrapersonal Intelligence. After entering the variable of years of specialized training and weekly specialized training hours in model 2, the F value had reached significant level and so did t values of both years of specialized training and weekly specialized training hours, and the R square also increased by 12.8%, which suggested years of specialized training and weekly specialized training hours contributed to the prediction of Intrapersonal Intelligence. Therefore, after controlling the age variable, years of specialized training and weekly specialized training hours could predict the development of athletes' Intrapersonal Intelligence as shown in TABLE IV.

TABLE IV
REGRESSION ANALYSIS OF INTRAPERSONAL INTELLIGENCE

	Model 1		Model 2	
	β	t	β	t
Age	.12	1.98*	.07	1.19
Years			.07	1.05
Weekly Hours			.17	2.52*
R2%		6.90		19.70
F		18.78*		20.55*
ΔR2%		6.90		12.80
ΔF		18.78*		20.02*

*p< .05

IV. DISCUSSION

Lajoie, Ronsky, Ramage, Robu, Richards and Mcfadyen [2] suggested the visual spatial ability of athletes was better than non-athletes. Lord and Leonard[13] also argued that athletes had better spatial sense than average people. Liu [19] tested the learning of sport skills and found sport skills would help individuals operating the visual image. Therefore, present study hypothesized that the Spatial Intelligence of athlete would be higher than non-athletes however the result didn't consist with the hypothesis. In fact, the scores of athletes on Spatial Intelligence were higher than non-athletes and the reason why it didn't reach the significant level might be that the visual spatial ability of athletes tended to be mobile visual ability [19-20] while in the Multiple Intelligences Theory, the definition of Spatial Intelligence by Gardner [8] included graphic design and ability of compositing pictures. Therefore after generalizing the scores of each element, the total scores of Spatial Intelligence obtained by athletes weren't remarkably superior to non-athletes.The major components of Musical Intelligence included, instrument operation, singing ability, and musicality; while the major components of Naturalist Intelligence included, the observations on animals, plants, and natural environment. These components had no direct connections with the trainings and lives of athletes. Therefore it was comprehensible that there were no significant differences appeared in these two intelligences between athletes and non-athletes. Non-athletes had higher Linguistic and Logical-Mathematic Intelligences than athletes. The key factors of Linguistic Intelligence included grammar application, linguistic structure, pronouncing, and vocabulary; while the key factors of Logical-Mathematic Intelligence were deduction, summarization, calculation, hypothesis, and authentication. All these factors were applicative which required training and learning to be improved. Nonetheless, the time athletes involved in academic works were relatively less under the current sport training system [21] and these factors above were majorly obtained from the classes so that athletes scored notably less on Linguistic and Logical-Mathematic Intelligences scales than non-athletes. It was suggested athletes had higher inter-personal and Bodily-kinesthetic Intelligences

than non-athletes in present study which consisted with the hypothesis. Sherlock [15] argued that the Interpersonal and Bodily-kinesthetic Intelligences of athletes were even better developed and the results of present study supported such statement. It could be reasonably inferred that athletes had higher Bodily-kinesthetic Intelligence and the differences on Interpersonal Intelligence might be resulted from the satisfaction of athletes obtained in sports environment. Hsu [22] mentioned, athletes would form a sport friendship during their adolescence which included better improvement of self-esteem, self-support, and emotional support. Aoyagi, Cox, and Mcquire [12] also argued that the satisfaction of athletes was positively related to the team consolidation. In addition, the Intrapersonal Intelligence of athletes was higher than non-athletes which also conformed to the hypothesis of present study. Jonker, Gemser and Visscher [11] suggested that athletes were good at self-reflection which also was positively related to their sport performances. Powers, Koestner, Lacaille, Kwan & Zuroff [14] also proposed, self-judgement indeed existed in the sports world. The statements mentioned above could explain why athletes had higher Intrapersonal Intelligence.For future studies, the second examination of present study was following the suggestions by Sherlock [15]. It was found that the years of specialized training and weekly specialized training hours of athletes could effectively predict the dominant intelligences: interpersonal Intelligence, Bodily-kinesthetic Intelligence, and Intrapersonal Intelligence of athletes in present study. However, the theoretical supports of the predictability of years of specialized training and weekly specialized training hours were still insufficient therefore future studies may head to such direction. It was also suggested that the Linguistic Intelligence and Logical-Mathematic Intelligence of athletes were less developed in present study. Therefore future study can focus on how to use the Bridge Strategy to assist developing disadvantage intelligences of athletes with the dominant intelligences without influencing the training efficacy [7].

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