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Comparison of motor efficiency and emotional intelligence of ordinary and gifted girl students aged 12-15 years

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Abstract

Background: The research showed that having high scientific intelligence in students does not necessarily imply higher emotional intelligence or better motor efficiency, and these relationships may vary among individuals with different levels of intelligence.

Aim: The present study was conducted to compare the motor efficiency and emotional intelligence of ordinary and gifted girls' students aged 12-15 years.

Materials and Methods: The present research was a causal-comparative study. This study was conducted on 100 participants two equal groups (50 gifted girls' students from National Organization for Development of Exceptional Talant (NODET) and 50 ordinary girls' students from ordinary schools) using random sampling method from 6 ordinary schools and 3 NODET schools in the first secondary level in Shiraz. The Trait Emotional Intelligence Questionnaire– Adolescent Short Form (TEIQue-ASF) and the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) were used to measure emotional intelligence and motor efficiency, respectively.

Results: The results showed that the motor performance of gifted students was significantly better than ordinary students (P=0.029). However, there was no significant difference in the emotional intelligence variable between the two groups (P<0.05).

Conclusion: The research results indicated a significant difference in motor efficiency between gifted and ordinary students. This finding underscores the need for a more in-depth investigation into the potential causes of this disparity. Factors to consider include variations in the physical environment of schools, access to sports facilities, the role of physical activity and sports outside of school, and the differing social and economic backgrounds of families.

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1. Introduction

Cognitive skills are understood as mental actions or precursors to acquire knowledge and understanding through thought, experience, and senses. These skills include metacognitive skills such as response inhibition, planning, attention, working memory, and intelligence [1, 2]. Metacognitive skills are defined as the conscious skills of regulating and directing cognitive processes. In other words, metacognition refers to a student's awareness and control over their own cognitive processes. These skills help students to have mastery over their mental processes and plan and act towards achieving their cognitive goals [3].

Among these, intelligence provides humans with the opportunity to interact effectively with their environment. Many American and European psychologists who have studied intelligence believe that intelligence is a general ability that encompasses many cognitive domains [4, 5]. In general, intelligence can be defined as the ability to problem-solve, learn, plan, think critically and creatively, as well as the ability to understand the environment [6]. Different experts have presented diverse perspectives on the nature and structure of intelligence. For example, Thurstone (1943) introduced intelligence as a set of distinct mental abilities such as verbal comprehension, perceptual speed, and inductive reasoning [7]. In contrast, Spearman (2008) viewed intelligence as a unidimensional general ability that covers all mental abilities [8]. Additionally, Van Der and Veenman (2014) with his theory of multiple intelligences, considered intelligence as a set of distinct abilities that operate independently [9].

Adolescence is one of the most crucial periods of growth and development in a person's life. This period is characterized by physical, cognitive, and socio-emotional changes. Adolescence primarily encompasses the ages of 12 to 18 years, with a portion belonging to the period of puberty [9]. During this time, adolescents acquire new experiences and take on greater responsibilities [10]. Additionally, during this period, adolescents show continuous improvement in cognitive skills such as planning, working memory, and response inhibition [11]. Attending the development of cognitive skills during adolescence is of great importance, as the brain undergoes significant growth, and cognitive abilities evolve during this time. Therefore, the examination and comparison of the progress of cognitive skills, especially metacognitive skills, among gifted and average adolescents is of great significance [12].

On the other hand, various studies have shown the relationship between intelligence and motor efficiency. Specifically, students with lower intelligence compared to average students face challenges in motor skills such as coordination, balance, and gait due to physical and developmental disabilities [13, 14]. Based on this, it is expected that general intelligence would have a direct relationship with motor abilities. Motor development, as an important ability, should be evaluated in relation to intelligence. In other words, physical, mental, and emotional development directly affect students' social behaviour [15].

However, there is still ambiguity regarding the relationship between intelligence and motor characteristics in students with above-average intelligence. Some studies have shown that intelligence scores do not have a significant relationship with the motor skills of gifted students [16,

17]. These results suggest that the common framework regarding the direct relationship between intelligence and motor development may not apply to gifted students, and the debate on the nature and dimensions of intelligence and its relationship with motor skills continues. Individuals with poor motor competence (MC) are by consequence at risk for not having opportunities to learn peer-related social skills, which puts them at risk for emotional problems such as depressions and anxiety [18].

Nevertheless, despite a) the environmental stress hypothesis providing a theoretical framework for the reciprocal EI-MC relationship, and b) the evidence that EI-MC are positively associated with a wide variety of health-related outcomes, there is a considerable and surprising shortcoming in knowledge about the potential direct relationship between both constructs [19].

Therefore, the identification of cognitive and motor abilities in gifted students is of particular importance. Additionally, emotional intelligence is considered one of the factors related to social adaptation and success. Emotional intelligence is defined as the ability to identify, understand, and manage one's own and others' emotions, and plays an important role in individuals' academic and social progress. This aspect of intelligence refers to characteristics such as self-awareness, self-regulation, motivation, empathy, and social skills, and plays an important role in students' adaptation and success [20, 21]. High EI is assumed to facilitate efficiency in many domains of human functioning and development [22]. For example, Shah et al. (2014) reported a positive relationship between EI and academic achievement in medical undergraduates [23]. Naik and Kiran (2018) reported that EI increases student achievement motivation [24]. Closer to the domain of motor development and PA, positive associations between EI and efficiency in learning writing skills, increased PA levels, and positive attitudes towards physical activity have been reported [25]. Such a positive attitude is beneficial to the development of an active lifestyle, including the development of a sufficient level of MC alluded to in the environmental stress hypothesis [26].

Gifted students may often lack adequate emotional intelligence, as their emphasis tends to be more on cognitive and mental abilities rather than on social and emotional skills [19]. Consequently, comparing motor skills and emotional intelligence between gifted and average students can yield valuable insights for specialists. Understanding the characteristics of these two groups can inform strategies aimed at enhancing their cognitive, motor, and emotional skills.

For instance, implementing targeted training programs and improving educational environments can promote a balanced development of various aspects of gifted students' personalities. While numerous studies have explored the relationship between intelligence and motor efficiency or emotional intelligence in students [27], ambiguities still exist regarding the correlation between intelligence and motor skills, particularly among students with high intelligence. This highlights the need for further research in this area.

The scarcity of research and the uncertainties surrounding the comparison of groups with differing levels of cognitive development and scientific intelligence, especially during adolescence, necessitate investigations into the physical, social, and psychological differences experienced during puberty. This exploration is crucial

for understanding individuals in the final stage of Gallahoe's hourglass theory, which pertains to lifelong utilization, as well as in the context of Piaget's formal operations stage [28]. Therefore, conducting research in the domains of motor development and emotional intelligence, with a focus on efficiency and emotional skills, is essential.

2. Materials and Methods

2.1. Participation

The statistical population of this research comprised all students from ordinary (average) and NODET (gifted) schools in Shiraz city, enrolled during the academic year 2017-2018. To determine the sample in ordinary schools, a cluster sampling method was employed, while a random sampling method was utilized for NODET schools, which included a total of four schools across four districts of Shiraz. Additionally, random sampling was applied to select classes.

In total, 100 participants were selected, consisting of 50 gifted students with an average age of 13.45 and 50 ordinary students with an average age of 13.63. It is noteworthy that among these participants, 91 students (42 gifted and 49 ordinary) had reached puberty.

2.2. Instrument

2.2.1. Informed consent form and personal information

The inclusion criteria for participants in this research were based on the ethical principles of the Helsinki Declaration. Prior to the administration of the tests, the participants completed an informed consent form and a personal information questionnaire.

The exclusion criteria included age outside the range of 12 to 15 years, as well as any physical or mental disabilities that could affect the participants' performance on the tests.

2.2.2. Trait Emotional Intelligence Questionnaire-Adolescent Short Form (TEIQue-ASF)

Bayani reported an internal consistency coefficient of 0.82 with 306 participants in Iran [29]. Also, the validity and reliability of this questionnaire has been reported in other desirable countries [30, 31].

This questionnaire has a 7-point Likert scale (7= strongly agree, 1= strongly disagree, 4= neither agree nor disagree), and items 16, 2, 18, 4, 5, 7, 22, 8, 10, 25, 26, 12, 13, 28, 14 are scored in reverse. After reversing the scores of the relevant items, the scores of all items are summed. The highest possible score on this questionnaire is 210, and the lowest is 30. A low score close to 30 indicates low emotional intelligence, while a high score close to 210 indicates high emotional intelligence. The mean and standard deviation of the students on this questionnaire were 130.30 and 20.45, respectively. Therefore, students who score 110 or below are considered to have low emotional intelligence, those who score between 110 and 150 are considered to have average emotional intelligence, and those who score above 150 are considered to have high emotional intelligence.

2.2.3. The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)

The Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) is designed to assess gross and fine motor skills in children between the ages of 4.5 and 14.5 years. The validity and reliability of this test have been reported as desirable in Iran and other countries [32, 33].

In 2002, this test was revised, and in 2005 it was published as the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). The new version includes more practical applications, increased gross and fine motor skills,

expanded age range up to 21 years, and improved quality of equipment. The BOT-2 test is designed by researchers, physiologists, occupational therapists, and physical education teachers to assess children with motor disorders [34]. The BOT-2 has two forms: complete and short.

The short form includes four subtests with 8 subtests: fine manual control, manual coordination, body coordination, and strength and agility [35]. In the short form of this test, the examinee must perform 14 tasks, including sit-ups, Swedish swimming, scissor jump, placing coins in a container with both hands, simultaneous upper and lower limb movement, walking on a straight line, standing on a balance beam, throwing and catching a ball with both hands, bouncing a ball with both hands simultaneously, drawing a maze, copying a star shape, drawing the edge of a sheet, and copying a square shape.

2.2.4. Procedure

After obtaining the necessary approvals and coordinating the relevant arrangements, the data collection process began with a trained expert team. Initially, the participants completed the informed consent form. They then proceeded to fill out the Trait Emotional Intelligence Questionnaire-Adolescent Short Form (TEIQue-ASF). Finally, the participants took part in the Bruininks-Oseretsky Test (BOT-2) according to the instructions, and the scores of each participant were recorded and coded for storage.

It is important to note that the administration of the Bruininks-Oseretsky Test (BOT-2) took approximately 20 min per student, and the entire data collection process related to the motor assessment spanned 40 working hours, equivalent to 10 days. Moreover, the testing conditions were kept consistent for all participants to ensure standardized administration of the BOT-2.

Figure 1. Instruments and administration of the test

2.3. Statistic

Initially, descriptive statistics were used for the descriptive findings of the research, and then inferential statistics and independent t-tests were employed to analysis the results. The assumptions of inferential statistics relevant to this study, including the homogeneity and normality of the distribution of the independent variable, were satisfied. Level of significance for all inferential statistical methods was set at $P<0.05$, and SPSS version 24 software was used for data analysis.

The G*Power software was used to determine the adequacy of the sample size.

3. Results

The results of the present study showed that despite the superior motor ability (M=92.7±14.15) of gifted students compared to regular students (M=81.08±12.99), there was no significant difference (sig=0.812) in emotional intelligence between these two groups (gifted: M=129.19±10.86, regular: M=128.65±12.2, sig=0.029; Table 1 & 2). Furthermore, the average age of reaching sexual maturity in the group of gifted students (M=12.07±2.09 years) and regular students (M=12.23±0.89 years) was almost similar and in a comparable state. Overall, these results indicate that the superiority of gifted students in motor ability does not necessarily indicate a difference in emotional intelligence or the age of sexual maturity compared to regular students, and these two groups are in a similar situation in this regard.

As observed in Table 1, the independent t-test showed that the motor efficiency of gifted students was significantly better than ordinary students (P=0.029).

As observed in Table 2, the independent t-test results showed that there was no significant difference in emotional intelligence between the gifted and ordinary student groups (P=0.812).

Table 3 shows that the total number of participants is 100, with 50 gifted students and 50 ordinary students. The mean age, height, and weight for each group are also provided, with the standard deviations shown.

Table 1. Independent t-test results comparing the "motor efficiency" of the participants

	Students	Mean	Standard deviation	Standard error	Significance level
Motor efficiency	Gifted	92.7	14.15	2	0.029
	Ordinary	81.08	12.99	1.83	

* The $P< 0.05$ was considered statistically significant.

Table 2. Independent t-test results comparing the "emotional intelligence" of the participants

	Students	Mean	Standard deviation	Standard error	Significance level
Emotional intelligence	Gifted	129.19	10.86	1.52	0.812
	Ordinary	128.65	12.2	1.69	

* The $P< 0.05$ was considered statistically significant.

Table 3. Descriptive information related to age, height, and weight of the participants

Statistical index	NODET school (Gifted)	ordinary school (Normal)	Total
Frequency	50	50	100
Percentage	%50	%50	%100
Age (years)	13.45±0.94	13.63±0.81	13.54±0.88
Mean height (m)	1.61±0.05	1.62±0.07	1.61±0.06
Mean weight (kg)	51±10.31	53±13.21	52±11.84

4. Discussion

Motor and cognitive development are recognized as two fundamental aspects in human evolution and have always been of interest to researchers. One of the influential factors in cognitive development is intelligence, which plays a key role in academic achievement and cognitive functions. The present study was conducted to compare emotional intelligence and motor efficiency between ordinary and gifted girl students of aged 12-15 years.

The results showed that the motor efficiency of gifted students was significantly better than ordinary students (P=0.029). However, there was no significant difference in the emotional intelligence variable between the two groups (P<0.05).

These results indicate that the superiority of gifted students in motor efficiency does not necessarily indicate a difference in emotional intelligence. Research evidence also suggests a relationship between intelligence and motor abilities [35, 36]. In this regard, numerous studies have investigated the relationship between intelligence and motor development. The results of a study by Afzali et al. (2016) showed that gifted students had better motor efficiency compared to their average peers [37]. This finding is consistent with some previous studies that have confirmed the relationship between cognitive intelligence and motor abilities [38].

Among these consistent studies, we can refer to the research by Wang and Wang (2024) [39], Solis Ura et al. (2012) [40], Van der Fels (2015) [1], and Aktop (2010) [41]. In their investigations, these researchers found a significant relationship between intelligence and individuals' motor efficiency. They attributed the possible reasons for this relationship to the ability of gifted individuals in rapid information processing, working memory, and better cognitive control.

However, some other studies are inconsistent with these results. For example, Lari Lavasani and Hashemi Azar (2017) showed that there is no significant relationship between intelligence and motor abilities and used test of creative movement in action and movement of Torrance for measurement motor creativity and the fourth version of the Wechsler intelligence scales for measurement intelligence in children of elementary school (7-9 age) include 24 normal, 23 gifted and 27 learning disordered [42]. This inconsistency in the results may be due to differences in the age groups, gender, and cultural backgrounds studied, the tools used to measure intelligence and motor skills [43].

On the other hand, numerous studies have also been conducted on emotional intelligence and its relationship with motor and cognitive development. In this regard, some studies have reported a positive and significant relationship between emotional intelligence and motor abilities [44]. This relationship can be attributed to the role of emotional intelligence in emotion regulation, attention, and motivation of students for physical activities. For example, in a meta-analysis study, Kopp and Jekauc (2018) showed that emotional intelligence has a small but significant relationship with sports and motor skills. They stated that emotional intelligence as a predictor of sports performance can be encouraging [45].

However, as observed in the study by Afzali et al. (2016), some studies have not reported significant differences in emotional intelligence between gifted and ordinary students [37].

Some researchers have found a positive and significant relationship between emotional intelligence and sports and motor efficiency in this age group. For example, Mohammadi Orang et al. (2023) in a study of the relationship between emotional intelligence and motor competence in a sample of 540 children, adolescents and young adults, found that emotional intelligence and motor skills are strongly related from childhood to adulthood. Students with higher emotional intelligence also have better performance in motor skills. This relationship has been observed in all age groups. Additionally, boys generally outperform girls in motor skills, although this superiority of boys decreases with age, especially in students with low emotional intelligence [19].

Some theories and approaches emphasize the relationship between intelligence and motor abilities. For example, the interactionist theory (coordinated cognitive and motor development) believes that these two domains interact with each other, and development in one can affect the other (Lonedale, 1987). This theory holds that cognitive and motor skills develop in a coordinated manner and in relation to each other during growth. This means that progress in one of these two domains can lead to progress in the other domain. For example, improved information processing speed (a cognitive component) may lead to improved motor coordination (a motor component). Additionally, the information processing theory (Snow, 1989) believes that information processing related to motor and cognitive skills are interrelated. This theory states that information processing procedures form the basis of both types of skills (cognitive and motor) [46]. Therefore, a student's information processing abilities (such as processing speed, attention, and memory) can affect their motor and cognitive performance.

These findings suggest that intelligence in general (both cognitive and emotional) plays an important role in the growth and progress of adolescent girls in various aspects, including motor and academic. In other words, the cognitive and emotional abilities of students can affect their performance in different areas, including motor skills. Therefore, attention to the enhancement of intelligence (cognitive and emotional) in adolescence can lead to improved motor and academic performance of adolescent girls.

In summary, given the importance of motor and cognitive development in human evolution, as well as the key role of intelligence (both cognitive and emotional) in these processes, further research in this area seems essential. Studies have shown that cognitive and emotional intelligence are closely related to the development of motor skills and academic achievement in adolescents [47, 48]. In this regard, future research should adopt a multidimensional approach to investigate the relationship between intelligence (cognitive and emotional), motor efficiency, and academic achievement in diverse age and cultural groups. This type of study can contribute to a deeper understanding of the relationships among these constructs.

Although reasons of this difference can be related with speed of processing because it is means brain how do an action or reaction with how much speed. In this regard, Deary believes that speed of processing is a limiting or accelerating factor for cognitive development. During a person's developmental years, the appearance of a small individual difference in processing speed may cause large

differences in intelligence, vocabulary, and performance [49].

Therefore, the effect of processing speed, on the one hand, on performance, and on the other hand, cognitive development abilities, can become the basis of small and large individual differences in one of them or both abilities.

Of course, the apparent reasons of this difference, including low population in NODET, the difference in the physical space available in schools, the difference in access to sports facilities, considering the importance of physical activity and sports outside of school, possessed from different social and economic levels of family and out the small number of NODET schools.

Also, the design and implementation of long-term educational programs based on strengthening emotional intelligence along with cognitive and motor development can improve the components of emotional intelligence such as self-awareness, self-regulation, empathy and social skills and in addition to strengthening the cognitive and motor aspects, focus on creating an environment for the balanced and comprehensive development of teenagers. These comprehensives can be found to better understand the relationships between these constructs and develop interventions to support the holistic development of adolescents.

Additionally, considering economic results, increasing sports facilities in normal schools, considering the importance of physical activities and sports outside of school and other factors in front of social and family levels, it is possible to improve the motor efficiency of normal schools. Attention to limitations such as the lack of business control of some companies and the unevenness of the educational environment, the low number of NODET schools (only 4 schools in Shiraz city), the small population of gifted students, the lack of cooperation of some students and administrators, it is suggested that future research and educational programs should be integrated and multi-dimensional and strengthen different aspects of intelligence (cognitive and emotional), motor efficiency and academic progress on a large scale as be used as at the provincial or national level and be done with similar tools.

Conflict of interest

The authors declared no conflicts of interest.

Authors contributions

All authors contributed to the original idea, study design.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Department of Physical Education, Faculty of Educational Sciences and Psychology Shiraz university (protocol code SEP.14033.48.1853 and date 2024-06-17 of approval). Informed consent was obtained from all subjects involved in the study.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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