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Intelligence and Motor Development among Adolescents: Insights for Physical Education and Talent Identification

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Abstract

The present study investigated the relationship between verbal intelligence and motor skill learning in adolescent school children of Chhattisgarh, India. The research design used was quantitative correlational (q-c) type and the subjects were 180 adolescents gathered by stratified random sampling technique. Mixed Type Group Test of Intelligence (MGTI) developed by Mehrotra (1984) was used for measuring verbal intelligence, and motor skill learning was measured using motor educability scores. The descriptive statistics and correlation analysis with Pearson were used with SPSS 27. The results showed no significant correlation between discriminative intelligence (verbal) and motor educability in either boys ($r = 0.014$, $p = 0.892$) or girls ($r = -0.016$, $p = 0.879$). The study found that verbal intelligence has no significant role in motor learning of adolescent students, which indicated that other factors such as physical, psychological and environmental factors had a role in motor learning.

Keywords: Verbal Intelligence, Motor Educability, Motor Skill Learning, Adolescents, Talent Identification.

1. Introduction

Adolescence is an important period that is characterized by profound physical, cognitive, emotional and social changes that impact upon learning, performance, and overall growth. Motor intelligence is a cognitive process that involves the coordination of the motor system, such as balance, agility, and motor proficiency, and is closely related to other types of intelligence, including reasoning, problem solving, memory and decision making (Uktamovna, 2025; Aghanouri, 2024) [29, 1]. The relationship between cognitive functioning and motor competence is evident in the literature; for example, cognitive skills like attention, planning, and executive control are key factors in achieving good motor performance (Klotzbier & Schott, 2025) [10]. This relationship is significant in the field of physical education for the purpose of fostering all-round growth and recognizing athletic ability. There is a growing acceptance of the need to assess both physical and cognitive skills when identifying successful athletes and the assessment of intelligence and motor competence can be used to aid in evidence-based talent development among adolescents (Lazar & Ramakrishnan, 2026; Larkin *et al*., 2022) [15, 13].

1.1. Relationship between Intelligence and Motor Skill Competence in Adolescents

Adolescence is a very important developmental period where there are many changes in cognition, physiologic and psychologic development. During this period, intelligence is seen to have an important role in determining the motor skill competence, the ability to learn, think, solve problems, and adapt to various situations and situations (Uktamovna, 2025) [29]. Adolescents are able to interpret the movement patterns, make rapid decisions, and react to environmental stimuli because of cognitive functions like attention, memory, information processing, and executive functioning. Adolescents' cognitive development brings increased capacity to learn, develop and execute intricate motor activities that involve precision, coordination and strategic planning (Shi, *et al*., 2022) [24].

Motor skill competence is how well people are able to execute basic and specific motor skills such as balance, coordination, agility, reaction time and locomotors skills. The study suggests that there is a positive correlation between intelligence and motor development, meaning that adolescents with high cognitive functioning tend to show high motor functioning (Mazzardo, *et al*., 2024; 1-4) [18]. The relationship is described using cognitive-motor interaction in which the brain processes needed for planning, attention, and problem solving are related to the execution and control of the movement (Jaquess, *et al*., 2020) [9]. Empirical studies have found that motor competence and cognitive performance have

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consistently been shown to develop in a mutually reinforcing way, emphasizing the need to combine cognitive and physical development in education and sport. The results of such studies have important implications for programmes in physical education, talent identification, and for programmes of adolescent development (Sari, *et al*., 2025) [22].

1.2. Role of Physical Education in Enhancing Cognitive and Motor Development

Physical education has been a critical component in the development of young people, contributing to their cognitive development and motor skills. Adolescent's body and mind are in a phase of rapid change and growth, a time when they are highly susceptible to developing and improving movement skills (Hill, *et al*., 2024) [7]. Adolescent learners cultivate the motor skills needed for success in life through planned physical education instruction and sport involvement, which include: coordination, balance, agility, flexibility, and reaction time. The activities do not only help develop physical fitness, but also help develop the ability to execute complex movements efficiently and with confidence. Physical education offers ongoing opportunities to practice, learn or acquire skills and to explore movement, enhancing motor competence and a positive lifelong attitude to physical activity (Kurnaz, *et al*., 2024) [11].

Physical education has a significant influence on cognition and academic success in addition to motor development. There is evidence that regular exercise is linked to improvements in brain function, concentration, memory, attention span and problem-solving skills (Latino, F., & Tafuri, 2023) [14]. Strategic thinking, decision making and team work with physical activities, stimulate executive function and engage the mind. School-based physical education also contributes to adolescents' psychological well-being through the reduction of stress, enhancing self-esteem, and fostering socialization opportunities. Consequently, physical education is a key educational tool that fosters intellectual development, motor competency and the total development of the adolescent, which makes it a vital component in the education of well-rounded and healthy people (Herrero, *et al*., 2025) [6].

1.3. Talent Identification in Sports through Intelligence and Motor Assessment

Talent identification is the systematic process by which people with the potential to perform at a high level in sport are identified. The traditional approach to talent identification has largely been centered on physical qualities and abilities like strength, speed, endurance, and anthropometric traits (Zhao, *et al*., 2024) [30]. But, current theories focus on multiple dimensions such as cognitive, psychological and motor skill. Identifying talented athletes early allows coaches and sports institutions to offer them more specific training and development, thus optimizing their athletic potential (Lamri, J., & Lubart, 2023) [12]. Motor assessment tools are important in this process for measuring basic and sport-specific motor skills including coordination, balance, agility, reaction time, movement accuracy and motor control. These assessments aid in identifying children who exhibit high levels of motor competence and who have the motor base skills required to be successful in competitive sport (Silva, 2025) [25].

Over the last few years, there has been a growing amount of interest in the role of cognitive abilities in sports performance and talent identification. Intelligence, attention, decision making, problem solving, perceptual skills and executive functioning all play a role in how an athlete learns new skills, how well he or she adapts to changing game situations, and how well he or she can perform complex strategies under pressure (Spies, *et al*., 2022) [27]. Therefore, contemporary models of talent identification combine the intelligence assessment with assessment of motor and physical performance to obtain a more holistic picture of a sporting potential. Overall, these models can help identify athletes with the most promise for success, which can help inform the selection process for teams and organizations. This can be a great way to improve talent development programs and increase the chances of developing future elite athletes at an early age (Tang, *et al*., 2026) [28].

2. Review of Literature

Sliedrecht, *et al*., (2025) [26] studied the role of general motor skills in the identification of talented athletes from 6-18 years of age. Twenty-two studies, 13 cross sectional and 9 longitudinal, were reviewed to determine if general motor skill questionnaires could be used to identify talented from non-talented athletes. The results showed that most of the studies indicated that talented athletes had better general motor skills or no difference between talented and non-talented groups. The findings of the study indicated that general motor skills tests can be used as a supplement to talent identification programs, but were inconclusive. The review highlighted a need for more high-quality longitudinal studies, with analyses broken down by age and sex, greater coverage of the sports and evaluation of manipulative skills and movement quality in order to optimize the effectiveness of the talent identification process.

Marinho, *et al*., (2024) [17] examined the value of the generic motor tests for the identification of young sports talents and their value for predicting future sports performance. According to the PRISMA protocol, 20 studies (including cross-sectional, longitudinal, and retrospective studies of satisfactory methodological quality) were analyzed. The results showed the motor coordination was highly related to sports performance, and it can serve as an important criterion for talent identification, prediction of sports performance, and selection of athletes. Most studies were targeted at adolescent male soccer players and often employed the Körperkoordinationstest für Kinder (KTK) motor test. The review found that a generic motor assessment is a useful tool for determining sporting potential and that sports professionals can use a generic motor assessment to help guide youth training and talent development programmes.

Bowler, *et al*., (2024) [3] examining the relationship between early motor skills and later neurodevelopmental conditions, the researchers performed a systematic review and meta-analysis of 63 studies. Children who went on to develop diagnoses like autism, ADHD, developmental coordination disorder (DCD), and language disorders had substantial delays in a variety of important motor milestones such as head control, sitting, standing, crawling and walking. Motor performance was also found to be impaired in children with autism and language-related conditions as assessed in a standard manner. The study demonstrates the significance of early motor skill assessments in identifying and intervening with motor impairments and motor developmental delays early, as an important predictor of neurodevelopmental disorders.

Susanto, *et al*., (2023) sought to predict athleticism of children between the age range of 12-15 years and to identify children who have the potential to achieve in sports in the

future. The researchers used an ex post facto descriptive design and measured 507 children in Salatiga city and Lombok city using ten talent prediction tests namely anthropometric measurement, flexibility test, speed test, power test, coordination test, endurance test. The results indicated that 2% were very talented, 9% were talented, 16.5% were moderately talented while 72.5% were under talented. Through the results it was also possible to detect children who possess certain capabilities in when they are able to sprint, jump and throw. The study demonstrated the efficacy of talent identification tests for children and their ability to predict athletic ability, which can be used to inform early talent detection and sports development initiatives.

Mohammadi Orangi, *et al*., (2023) [19] investigated the relationship between emotional intelligence (EI) and motor competence (MC) in 540 children, adolescents, and young adults. The participants were divided into high, average and low EI groups using the Schutte Self-Report Emotional Intelligence Scale and motor competence was determined by the Bruininks–Oseretsky Test of Motor Proficiency (BOTMP-2SF). It was found that there was a strong and significant positive correlation between EI and MC in all age groups and gender. Higher EI scores were associated with higher motor competence scores throughout. Boys tended to score higher than girls in motor competence, but these differences were smaller as boys grew older. The study found that emotional intelligence was a significant correlate of motor competence throughout childhood to early adulthood.

Höner, *et al*., (2023) [8] examined that strong talent identification and development were vital to the success of sport associations and clubs in the long term, he emphasized. It considered different models and concepts about talent and expertise, and focused on the role of psychological factors like cognition, personality traits, achievement motivation and decision making capacity in sport performance. The findings indicated that psychological evaluation and intervention may be a useful tool in talent development to keep track of athletes' abilities and pinpoint the areas needing improvement. But the study reported that psychological features were not enough to be used for talent selection because of their lack of predicting future performance. Thus, sport psychology was seen as more appropriate for the development of talent rather than as the only criteria for the identification of talent.

Faber, *et al*., (2022) [5] analysed 31 studies from 2009–2019, examined modern approaches to talent identification and development in both school and sports settings. Through qualitative content analysis, the review highlighted important similarities and differences in talent programs in these contexts. The results indicated that the promotion of talent programs in schools might benefit from using strategies applied to sports, such as: Talented transfer pathways, Maturity level and sex differences, deliberate practice, Workload monitoring and accelerated learning opportunities. On the other hand, there are opportunities for the existing sports talent programmes to include school based programmes, such as universal screening, recognition of under-represented groups, enrichment programmes that are creative, and better education and accountability of coaches. The review resulted in some suggestions that could enhance talent identification and development initiatives in both settings, and note that there is a need to conduct additional research to assess the effectiveness and transferability of these programmes in other settings and countries.

Prieto-Ayuso, *et al*., (2020) [20] reviewed international studies published from 2009 to 2019 on identification and development of talent in physical education (PE). The researchers employed a mixed systematic review approach using PRISMA guidelines to analyse 11 eligible studies that were conducted with school students. The results showed a progressive evolution in the approach to talent identification and assessment methods, with a stronger focus on improving children's health and their ability to participate and engage in sports. It also identified the need for clarity regarding school policies and guidelines to support the talented pupils in PE. In addition, the study indicated that alternative development programs were more successful in developing talent, as well as in minimizing the risk of disconnection from physical activity and sports participation, rather than traditional elite athlete models.

3. Research Gap

Although there has been a significant amount of research in the field of talent identification, there are still significant gaps in the literature. Motor competence, motor coordination, and general motor skills have been shown to be relevant factors affecting sports performance and talent development in previous studies (Marinho *et al*., 2024[17]; Sliedrecht *et al*., 2025[26]; Susanto *et al*., 2023). In the same way, the role of emotional intelligence and psychological aspects on motor competence and athletic outcomes has been demonstrated (Mohammadi Orangi *et al*., 2023[19]; Höner *et al*., 2023[8]). Most studies, however, have focused on cognitive, psychological and motor factors one by one and neglected to consider the interplay of these factors in the process of talent identification. In addition, the current models for talent identification are mainly focused on physical performance but also fail to consider the inclusion of intelligence and competence in motor skills (Prieto-Ayuso *et al*., 2020[20]; Faber *et al*., 2022 [5]). Thus, there is a need for empirical studies examining the correlations between intelligence and motor skill competence in adolescents, as well as the interaction between both in the context of effective talent identification in sports and physical education.

4. Statement of the Problem

Adolescence is a critical developmental stage in which there are major cognitive and motor changes that impact on learning, academic performance and physical performance. Intelligence and motor skill learning are sometimes viewed as being interrelated and thus both have complex neurological and psychological processes. There are multiple studies that have reported positive relationships between cognitive functioning and motor competence; however, these relationships vary in both nature and magnitude depending on population and context. Moreover, there is little study that explores the correlation between verbal intelligence and motor educability in the context of school students in adolescence, especially in an Indian context. For educators, physical education professionals, and talent identification programmes, it is important that they know if verbal intelligence aids motor skill learning. Hence the present study is undertaken to study the correlation between verbal intelligence and motor skill learning in adolescent boys and girls of Chhattisgarh, India.

5. Research Methodology

The quantitative type of research was used to investigate the relation between Motor Educability and intelligence of adolescent school children of Chhattisgarh, India. A correlational research design was used to find out the amount

of relationship among the research variables. The population of the study was the adolescent school students and a sample of 180 participants was randomly drawn from the population using stratified random sampling to ensure that the groups are well represented. Primary and secondary data sources were used in the study. The measures used for primary data collection were Mixed Type Group Test of Intelligence, developed by Mehrotra (1984) and relevant secondary data were obtained from books, journals and other sources of literature. The Motor Educability Score was used as the independent variable and the Verbal Score from the intelligence test as the dependent variable in this study. The data collected were analysed by using MS Excel and SPSS Version 27. The descriptive statistical and Correlation techniques were employed in summarization of the data and its investigation of the correlation between motor educability and verbal intelligence of respondents respectively.

6. Data Analysis and Interpretation

Table 1: Demographic Characteristics

S. No.	Demographic Characteristics	Category	Number of Respondents (N)	Percentage (%)
1.	Age	13 Years	30	16.7
		14 Years	27	15.0
		15 Years	27	15.0
		16 Years	29	16.1
		17 Years	21	11.7
		18 Years	22	12.2
		19 Years	24	13.3
2.	Gender	Male	90	50.0
		Female	90	50.0
3.	Class	Class VIII	30	16.7
		Class IX	27	15.0
		Class X	27	15.0
		Class XI	29	16.1
		Class XII	67	37.2
4.	School Type	Private School	99	55.0
		Public School	81	45.0
5.	Area of Residence	Rural	97	53.9
		Urban	83	46.1
6.	Father's Occupation	Businessman	30	16.7
		Doctor	15	8.3
		Driver	29	16.1
		Engineer	24	13.3
		Farmer	27	15.0
		Shopkeeper	26	14.4
		Teacher	29	16.1
7.	Monthly Family Income (₹)	15,000	27	15.0
		18,000	29	16.1
		25,000	26	14.4
		30,000	29	16.1
		60,000	24	13.3
		70,000	30	16.7
		80,000	15	8.3

Table 1 shows the demographic characteristics of the 180 adolescent respondents that were included in the study. The age distribution was relatively even with the highest proportion at 13 years (16.7%) and 16 years (16.1%) with the lowest proportion at 17 years (11.7%). There was an equitable distribution of males and females, 50.0% and 50.0% respectively. As far as education is concerned, the maximum number of respondents were from Class XII (37.2%) followed by Class VIII (16.7%) and Class XI (16.1%). Regarding type of school, most respondents were studying in a private school (55.0%) and 45.0% in a public school. The majority of the respondents were from rural areas (53.9%) with urban areas making up 46.1%. The respondents were from various socioeconomic statuses as seen from the fathers' occupation and monthly income of the family. Businessmen (16.7%), teachers (16.1%) and drivers (16.1%) were the largest occupational groups, while doctors (8.3%) were the smallest. In a similar trend, the highest proportion (16.7%) was observed in income group ₹70,000 and the lowest proportion (8.3%) was observed in income group ₹80,000. In general, the demographic variables suggest a fairly diverse and representative sample that is appropriate for investigating the relationship between intelligence and motor skill competence among adolescents.

Obj 1. To examine the relationship of verbal intelligence as an aspect of cognitive functioning on motor skill learning in adolescent boys.

H_1: A significant relationship will be observed between verbal intelligence as an aspect of cognitive functioning and motor skill learning in adolescent boys.

Table 2: Descriptive Statistics

Descriptive Statistics			
	Mean	Std. Deviation	N
Motor Educability Score	32.9333	9.08363	90
Verbal Score	31.6556	7.25485	90

The descriptive statistics for Motor Educability Score and Verbal Score of 90 respondents is described in Table 2. Motor Educability Score (M.E.S.) had a mean score of 32.93 and a standard deviation of 9.08, which represents a moderate level of motor skill learning ability among the participants, with some variations. Likewise, the mean Verbal Score was 31.66 and the standard deviation was 7.25, indicating a moderate Verbal intelligence level with comparatively low variation as compared to the motor educability level. The overall result would suggest that the respondents had a level of performance that are considered to be moderate in both motor educability and verbal intelligence and they also showed a good variability in their scores which would serve as a good basis for further correlation analysis.

Table 3: Correlations

Correlations			
		Motor Educability Score	Verbal Score
Motor Educability Score	Pearson Correlation	1	.014
	Sig. (2-tailed)		.892
	N	90	90
Verbal Score	Pearson Correlation	.014	1
	Sig. (2-tailed)	.892	
	N	90	90

The Pearson correlation analysis was conducted between Motor Educability Score and Verbal Score with 90 respondents, as shown in Table 3. The value of the correlation coefficient (r = 0.014) shows that there is very little positive correlation between the two variables. The significance value (p = 0.892) is very high compared to the accepted value (0.05), indicating that the relationship is not statistically significant. The results indicate that there was no significant relationship between verbal intelligence and motor educability of the respondents. Therefore, verbal scores were not significantly different and therefore the null hypothesis is accepted as true, meaning that variations in verbal scores do not significantly influence motor skill learning ability.

Obj 2. To examine the relationship of verbal intelligence as an aspect of cognitive functioning on motor skill learning in adolescent girls.

H_2: A significant relationship will be observed between verbal intelligence as an aspect of cognitive functioning and motor skill learning in adolescent girls.

Table 4: Descriptive Statistics

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
Motor Educability Score	33.1556	8.87480	90
Verbal Score	33.4111	7.65535	90

The descriptive statistics for Motor Educability Score and Verbal Score for 90 respondents are given in Table 4. The average Motor Educability Score was 33.16 (SD = 8.87) representing moderate level of motor skill learning ability and variation among the participants. The mean Verbal Score was slightly higher at 33.41, with a standard deviation of 7.66, which indicates that respondents had a moderate level of verbal intelligence, with relatively consistent performance. The standard deviation of Motor Educability Score was greater than that of Verbal Score which showed that motor skill learning differed more than verbal intelligence. The overall results indicate that the respondents' motor educability and verbal intelligence were of moderate levels with an adequate range for statistical analysis.

Table 5: Correlations

Correlations			
		Motor Educability Score	**Verbal Score**
Motor Educability Score	Pearson Correlation	1	-.016
	Sig. (2-tailed)		.879
	N	90	90
Verbal Score	Pearson Correlation	-.016	1
	Sig. (2-tailed)	.879	
	N	90	90

The Pearson correlation analysis of the 90 respondents is shown in Table 5 between Motor Educability Score and Verbal Score. There is an extremely weak negative correlation between both variables (r = -0.016). Therefore, the significance value (p = 0.879) is quite high and is not statistically significant with the value of 0.05. This indicates that there was no relationship between changes in verbal intelligence and changes in motor educability on the respondents. Thus, verbal intelligence seems to be unrelated to motor skill learning ability, and a null hypothesis is accepted.

7. Discussion

No significant correlation was found between the verbal intelligence and motor educability for the adolescent boys (r = 0.014, p = 0.892) and adolescent girls (r = -0.016, p = 0.879) of the present study. These results indicate that the role of verbal cognitive abilities in motor skill learning is very small in adolescents. Results are consistent with earlier studies showing that learning of motor skills is more shaped by opportunities for practice, physical activity involvement, coordination and experiences in the environment than by verbal intelligence. Schmidt and Lee (2019) highlighted the fact that motor learning relies mainly on motor control processes, practice and feedback mechanisms, not on language-based cognitive abilities. Likewise, Robinson *et al*. (2015) described that movement experiences and physical engagement are important for motor competence, and Barnett *et al*. (2016) noted that physical, social, and environmental factors are significant in motor development. Diamond (2015) also pointed out that cognitive functions are a factor in motor performance, but verbal intelligence is not a strong predictor of motor skill acquisition. Based on the present results, then, it can be concluded that motor educability and verbal intelligence are developing relatively independent, and that the successful acquisition of motor skills among adolescents may be based more on physical and experiential factors than on verbal cognitive factors.

8. Conclusion

The present study aimed to investigate the correlation between verbal intelligence and motor skill learning in adolescent boys and girls of Chhattisgarh. Results indicated that within each group there was no significant relationship between the verbal intelligence and the motor educability. The respondents had moderately high verbal intelligence and moderate levels of motor skill learning but verbal intelligence was not shown to be a significant predictor of motor educability. The findings indicate that verbal cognitive skills may not play as important a role in motor skill acquisition in adolescents as practice, physical activity inclusion, coordination, motivation, and environmental experiences do. The findings of the study underscore the need to take into account several aspects of adolescent development when planning physical education curriculum and talent identification programs. The future directions of the study might consider other cognitive domains that could have an impact on motor skill learning including executive functioning, attention, decision making, and non-verbal intelligence in order to further understand the cognitive-motor relationship.

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