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DEVELOPING MENTAL FLEXIBILITY AMONG HIGH SCHOOL STUDENTS BY MEANS OF SCHOOL SPORT ACTIVITIES IN ALGERIA

ABSTRACT

This study is aimed at studying the impact of school sports activities on mental flexibility of high school students in Algeria, by comparing participants and non-participants and examining the influence of activity type (*individual or team*), *practice regularity, and duration of experience. A descriptive comparative methodology was adopted, and data were collected from a random sample of 200 students enrolled in Algerian secondary schools during the 2024–2025 academic year, regardless of gender or grade level. Research instruments included a self-administered questionnaire on school sports participation and a standardized mental flexibility scale, while statistical analyses were carried out using Pearson correlation coefficients and independent samples T-tests through SPSS 25. mental flexibility.*

The results demonstrated statistically significant differences in favor of students who participated in school sports activities compared to their non-participating peers. More specifically, those engaged in team sports displayed higher levels of mental flexibility than students practicing individual sports. Moreover, participants who exercised three or more times per week achieved significantly better scores in cognitive adaptability, problem-solving flexibility, and creativity than those with less frequent practice. Students with more than one year of continuous sports experience also showed superior results compared to those with shorter engagement, confirming the cumulative benefits of long-term practice.

These findings highlight the essential role of school-based sports in fostering students' cognitive adaptability, resilience, and innovative thinking. The study concludes that regular and sustained participation in sports – particularly team-based activities – not only enhances physical fitness but also contributes to psychological well-being and cognitive development. Accordingly, it is recommended that Algerian educational institutions integrate structured and diverse sports activities into the curriculum, provide adequate resources and trained staff, and promote a culture that values physical activity as a tool for mental and educational growth. The results further suggest that future research should explore the interaction between sports, cognitive flexibility, and socio-cultural variables in order to design evidence-based interventions for improving both academic performance and life skills among students.

Keywords**:** *mental flexibility, school sports activities, high school students, Algeria, cognitive development, team-based activities.*

ФОРМУВАННЯ МЕНТАЛЬНОЇ ГНУЧКОСТІ УЧНІВ СТАРШИХ КЛАСІВ ЗАСОБАМИ ШКІЛЬНОЇ СПОРТИВНОЇ ДІЯЛЬНОСТІ У АЛЖИРІ

АНОТАЦІЯ

Це дослідження мало на меті вивчити вплив шкільних спортивних занять на розумову гнучкість серед старшокласників Алжиру, порівнюючи учасників та неучасників, а також вивчаючи вплив типу діяльності (*індивідуальний чи командний спорт*)*, регулярності занять і тривалості досвіду. Для цього було обрано описово-порівняльний метод, а дані було зібрано з випадкової вибірки з 200 студентів, які навчаються в середніх школах Алжиру в 2024–2025 навчальному році, без урахування статі чи класу. Дослідження проводилося в середніх школах Алжиру. Інструменти дослідження включали заповнення анкети про участь у шкільних спортивних заняттях та стандартизовану шкалу розумової гнучкості, а статистичний аналіз проводився з використанням коефіцієнтів кореляції Пірсона.*

Результати показали статистично значущі відмінності на користь студентів, які брали участь у шкільних спортивних заходах, порівняно з їхніми однолітками, які не брали участі. Зокрема, ті, хто займався командними видами спорту, продемонстрували вищий рівень розумової гнучкості порівняно з учнями, які практикували індивідуальні види спорту. Крім того, учасники, які тренувалися три рази на тиждень чи більше, досягли значно кращих результатів у когнітивній адаптивності, гнучкості вирішення проблем та творчості, ніж ті, хто займався рідше. Студенти з більш ніж річним досвідом спортивної практики також показали кращі результати порівняно з тими, хто займався рідше, підтверджуючи кумулятивні переваги довгострокових занять.

Результати підкреслюють важливу роль шкільного спорту у розвитку когнітивної адаптивності, стійкості та інноваційного мислення у студентів. Дослідження робить висновок, що регулярна та тривала участь у спортивних заняттях – особливо командних видах спорту – не лише покращує фізичну форму, але й сприяє психологічному благополуччю та когнітивному розвитку. Відповідно, рекомендується, щоб алжирські освітні установи інтегрували структуровані та різноманітні спортивні заняття в навчальну програму, забезпечували необхідні ресурси та кваліфікований персонал, а також сприяли культурі, яка передбачає фізичну активність як інструмент для розвитку розумових та освітніх навичок.

Результати також вказують на необхідність дослідження взаємодії між спортом, когнітивною гнучкістю та соціокультурними змінними для розробки обґрунтованих інтервенцій, спрямованих на покращення як академічних досягнень, так і життєвих навичок серед студентів.

***Ключові слова*:** *ментальна гнучкість, шкільна спортивна діяльність, учні старших класів, Алжир, когнітивний розвиток, командні види спорту.*

INTRODUCTION

Mental flexibility has emerged as a crucial competence for students in contemporary education systems, enabling them to adapt to challenges, manage stress, and think creatively in academic and social contexts. In Algeria, the increasing complexity of educational and societal demands underscores the importance of developing such cognitive skills among secondary school students.

Despite the recognized value of sports in promoting psychological and cognitive health, school-based physical activities in many contexts are still marginalized or treated as secondary compared to academic subjects. This situation raises questions about the extent to which sports are effectively integrated into educational programs in Algeria and whether they contribute to enhancing students' mental flexibility.

Previous international studies have demonstrated positive associations between sports participation and the development of adaptive cognitive skills; however, little is known about this relationship within the Algerian school context. This gap highlights the need for empirical research to examine the role of school sports in fostering mental flexibility among Algerian secondary school students.

THE AIM OF THE STUDY

This study aims to study the impact of school sports activities on mental flexibility among Algerian secondary school students, focusing on differences between participants and non-participants, the type of activity (team vs. individual), regularity of practice, and duration of experience.

THEORETICAL BACKGROUND AND RESEARCH METHODS

Taking into account the rapid changes witnessed in the modern era, mental flexibility has become one of the fundamental skills that learners need to keep pace with the demands of academic and professional life. Mental flexibility is defined as an individual's ability to adapt to new situations, solve problems creatively, and manage psychological stress efficiently (Clemente-Suárez et al., 2024). Schools play a pivotal role in developing this skill through their curricula and activities, with school sports activities being one of the most prominent mechanisms.

Numerous scientific studies indicate a positive relationship between sports practice and the development of cognitive functions, such as improving memory, increasing concentration, and developing strategic planning abilities (Shi et al., 2024). Moreover, sports, particularly team sports, teach students how to work within a team, accept differences, and adapt quickly to changing circumstances – all skills closely linked to mental flexibility (Dong et al., 2018).

However, the reality of sports activities in many educational institutions still suffers from lack of attention, whether at the planning or implementation level. Physical education classes are often marginalized in favor of academic subjects or practiced through routine activities that neither stimulate creativity nor develop mental skills (Sharma et al., 2024). This raises questions about the extent to which school sports are utilized as a tool for

developing mental flexibility, and the differences between students who regularly practice sports and their non-practicing peers.

These issues have been of interest to a number of researchers including N. Chen (2024), I. Fajardo (2003), I.G. Faulkner (2020), L. Ferguson (2020), E. Rhodes (2020), A. Sharma (2024), M. Vanderloo (2020), X. Yang (2024) and others.

The study employed a descriptive comparative research design, which is appropriate for analyzing and comparing the levels of mental flexibility among secondary school students who engage in school sports and those who do not. This approach enables the researcher to quantitatively describe naturally occurring differences between groups without experimental manipulation, making it particularly suitable for educational settings where interventions cannot be imposed.

RESULTS

Mental flexibility is considered one of the essential qualities that students should possess, representing the ability to adapt to challenges, manage stress, and think creatively (Yang et al., 2024). Studies indicate that this flexibility helps students face academic life pressures more effectively, leading to improved academic performance and increased overall life satisfaction (Martínez-Cuevas et al., 2024). Hence, the importance of developing mental flexibility in the academic environment emerges, as this cognitive ability is fundamental to helping students deal effectively with academic and social challenges.

In this context, school sports activities can play a crucial role in developing this flexibility, as sports practice contributes to developing the ability to adapt to different situations, enhancing problem-solving skills, and strengthening psychological and emotional endurance. Sports is not limited to improving physical fitness alone, but also works to enhance cognitive and emotional capabilities, such as self-control, flexible thinking, and positive dealing with failure (Chen, 2024). When sports activities are integrated within the school environment, they provide a safe and guided space that allows students to experience challenges, develop coping strategies, and build self-confidence, making them better prepared to face the demands of academic and professional life in the future (Xu, 2015).

Studies show that sports activities contribute significantly to developing psychological and physical health. Sports practice works to reduce stress levels and improve general mood, supporting the ability to face daily life challenges (Faulkner et al., 2020). Furthermore, research shows that practicing sports activities can lead to improved thinking skills (Huang et al., 2024).

Therefore, it is essential for schools to recognize the importance of sports activities and make them part of the academic curriculum. Schools should allocate sufficient resources to organize sports activities and integrate them more extensively into the academic curriculum, including training in sports skills and providing an appropriate environment that contributes to positive participation by all students. This also requires cooperation between teachers and sports specialists to ensure the delivery of a comprehensive program that aligns with the needs of all students, including those facing special challenges such as autism spectrum disorder (Levante et al., 2023).

In our study, students enrolled in Algerian secondary schools during the 2024–2025 academic year (N = 418) took part. A simple random sampling technique was used, ensuring that each student had an equal chance of being selected regardless of their sports participation status. A total of 200 students were selected and classified into two groups (practicing and non-practicing) based on their responses to the questionnaire.

Table 1

Distribution of study population by grade level

Grade Level	Number
First Year Secondary	140
Second Year Secondary	129
Third Year Secondary	149
Total	418

Source: Researcher, based on school records.

Instruments

Questionnaire. A self-administered questionnaire was designed based on the study framework and relevant literature. It included 15 items grouped into four dimensions: school sports practice and mental flexibility, type of school sport, regularity of sports practice, and duration of sports practice. Items were rated on a 3-point Likert scale (1 = Disagree, 2 = Neutral, 3 = Agree). The items were formulated in clear, simple language appropriate for the target age group to ensure clarity and avoid ambiguity. The instrument was reviewed by three experts to ensure content validity and was distributed electronically.

Table 2

Dimensions of the questionnaire and number of items

Dimension	Number of Items
Sports practice and mental flexibility	4
Type of school sport	3
Regularity of practice	3
Duration of practice	5
Total	15

Source: Developed by the researcher.

Mental Flexibility Scale. A mental flexibility scale was adapted from Martin and Rubin (1995), Cañas et al. (2003) and Spiro and Jehng (1990). It measures four sub-dimensions: cognitive adaptability, flexible problem-solving, acceptance of alternative perspectives, and creativity/innovation. The scale comprises 10 items, rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Higher scores indicate greater mental flexibilit

Table 3

Score ranges and interpretation for the mental flexibility scale

Score Range	Interpretation
10–20	Low mental flexibility
21–35	Moderate mental flexibility
36–50	High mental flexibility

Source: Adapted from M. Martin & R. Rubin (1995); J. Cañas et al. (2003); R. Spiro & J. Jehng (1990).

Validity and Reliability. Content validity was confirmed by three subject matter experts, with agreement percentages ranging from 90 % to 100 % using Cooper's formula. Test–retest reliability was established by administering the questionnaire twice with a one-week interval to a pilot group of 10 students. Pearson's correlation coefficients for all dimensions ranged from 0.802 to 0.918, and the total reliability coefficient was 0.937, indicating high consistency.

Table 4

Pearson correlation coefficients for the questionnaire dimensions (test–retest reliability)

Dimensions	Number of Items	Pearson Correlation Coefficient
First Dimension	04	0.802**
Second Dimension	03	0.913**
Third Dimension	03	0.918**
Fourth Dimension	05	0.896**
Overall Questionnaire	15	0.937**

Source: Researcher using IBM SPSS Statistics 25.

These results reflect a very strong correlation between test and retest, indicating a high level of reliability and trustworthiness in the questionnaire used.

Procedure. After obtaining administrative approval from the school, the questionnaire was distributed electronically to the selected students. Participants were informed about the purpose of the study, assured of confidentiality, and participation was voluntary. Collected data were coded, categorized into practitioners and non-practitioners, and analyzed using appropriate statistical techniques.

Data Analysis. Data were analyzed using IBM SPSS Statistics 25. Descriptive statistics (means, standard deviations, frequencies, and percentages) were calculated to summarize the characteristics of the sample. Inferential statistics, including Pearson correlation coefficients and independent samples T-tests, were conducted to test the study hypotheses and examine differences between groups.

Presentation and Analysis of Study Sample Responses to Questionnaire Items:

Table 5

Study Sample Responses According to Study Variables

Variable	Alt	Freq	Percentage	Mean	M.F. Mean
First Dimension	No	81	40.5 %	1.595	0.492
	Yes	119	59.5 %		
Second Dimension	Individual Sports	93	46.5 %	1.535	0.500
	Team Sports	107	53.5 %		
Third Dimension	Less than 3 times	86	43.0 %	1.570	0.496
	3 times and more	114	57.0 %		
Fourth Dimension	Less than one year	71	35.5 %	1.645	0.479
	More than one year	129	64.5 %		

Source: Researcher using IBM SPSS Statistics 25.

Table 5: The majority of the students reported practicing sports (59.5 %), with team sports slightly more common than individual sports. More than half engaged in practice at least three times per month, and nearly two-thirds reported over one year of sports experience. This distribution provides a strong base for testing the study hypotheses.

Study Sample Responses to Questionnaire Items:

Table 6

Study Sample Responses to Questionnaire Items

No.	Statement	Disagree	Neutral	Agree
01	I can change my way of thinking when facing an unexpected problem	17 (8.5 %)	98 (49.0 %)	85 (42.5 %)
02	I can deal with new information even if it contradicts my previous ideas	22 (11.0 %)	58 (29.0 %)	120 (60.0 %)
03	When circumstances change, I adapt quickly and adjust my plans	23 (11.5 %)	59 (29.5 %)	118 (59.0 %)
04	I seek new solutions when my usual method doesn't work to solve the problem	35 (17.5 %)	49 (24.5 %)	116 (58.0 %)
05	I have the ability to think of more than one way to solve the same problem	36 (18.0 %)	42 (21.0 %)	122 (61.0 %)
06	I can listen to different viewpoints from mine and think about them objectively	44 (22.0 %)	36 (18.0 %)	120 (60.0 %)
07	I have no difficulty accepting new ideas even if they are unfamiliar to me	46 (23.0 %)	44 (22.0 %)	110 (55.0 %)
08	I can find new ideas to solve the problems I face	51 (25.5 %)	38 (19.0%)	111 (55.5 %)
09	I enjoy trying new and unconventional ways to accomplish tasks	35 (17.5 %)	98 (49.0 %)	118 (59.0 %)
10	When I find that my decision was wrong, I can easily modify it without stubbornness	23 (11.5 %)	58 (29.0 %)	118 (59.0 %)
11	[Item statement not provided]	29 (14.5 %)	59 (29.5 %)	107 (53.5 %)

Source: Researcher using IBM SPSS Statistics 25.

The data presented in Table 6: The responses reveal generally positive attitudes toward adaptability and flexible thinking. Most students agreed with items related to problem-solving and openness to new ideas, while disagreement rates remained relatively low. This indicates that participants showed a good tendency toward mental flexibility, supporting the study's theoretical assumptions.

Study Sample Responses to Mental Flexibility Scale Items:

Table 7

Study Sample Responses to Mental Flexibility Scale Items

No.	Strongly Disagree Frequency	Disagree Frequency	Neutral Frequency	Agree Frequency	Strongly Agree Frequency
01	7 (3.5 %)	38 (19.0 %)	49 (24.5 %)	28 (14.0 %)	78 (39.0 %)
02	1 (0.5 %)	38 (19.0 %)	56 (28.0 %)	0 (0.0 %)	105 (52.5 %)
03	0 (0.0 %)	47 (23.5 %)	34 (17.0 %)	32 (16.0 %)	87 (43.5 %)
04	6 (3.0 %)	35 (17.5 %)	35 (17.5 %)	52 (26.0 %)	72 (36.0 %)
05	10 (5.0 %)	24 (12.0 %)	52 (26.0 %)	17 (8.5 %)	97 (48.5 %)
06	16 (8.0 %)	20 (10.0 %)	36 (18.0 %)	32 (16.0 %)	96 (48.0 %)
07	17 (8.5 %)	46 (23.0 %)	26 (13.0 %)	26 (13.0 %)	85 (42.5 %)
08	1 (0.5 %)	44 (22.0 %)	41 (20.5 %)	49 (24.5 %)	65 (32.5 %)
09	9 (4.5 %)	55 (27.5 %)	16 (8.0 %)	36 (18.0 %)	84 (42.0 %)
10	27 (13.5 %)	31 (15.5 %)	25 (12.5 %)	53 (26.5 %)	64 (32.0 %)
11	7 (3.5 %)	38 (19.0 %)	49 (24.5 %)	28 (14.0 %)	78 (39.0 %)

Source: Researcher using IBM SPSS Statistics 25.

The findings presented in the table 7: Agreement and strong agreement dominated across most items, showing that participants demonstrated high levels of adaptability, creativity, and acceptance of alternative perspectives. Only a small percentage expressed difficulty in modifying decisions (Item 10), suggesting a minor subgroup with lower flexibility.

T-Test Results for Sports Activity Practice on Mental Flexibility:

Table 8

T-Test Results for Sports Activity Practice on Mental Flexibility

Sports Activity Practice	N	Mean	Std. Dev	t calc	Sig. Level	Stat. Sig
Yes	119	46.25	2.98	–49.74	0.000	Statistically Significant
No	81	23.72	3.38			

Source: Researcher using IBM SPSS Statistics 25.

Nota. N = número de participantes; Mean = media; Std. Dev = desviación estándar; t calc = valor t calculado; Sig. Level = nivel de significación; Stat. Sig = significación estadística.

Table 8: The test results show significant differences in favor of sports practitioners, confirming that engaging in school sports has a clear positive effect on students' mental flexibility compared to non-practitioners.

T-Test Results for Type of Sports Activity on Mental Flexibility:

Table 9

T-Test Results for Type of Sports Activity on Mental Flexibility

Activity Type	N	Mean	Std. Dev	t calc	Sig. Level	Stat. Sig
Team Sports	107	46.30	2.97	–23.29	0.000	Statistically Significant
Individual Sports	93	26.57	8.17			

Source: Researcher using IBM SPSS Statistics 25.

Table 9: Team sports participants recorded significantly higher flexibility scores than individual sports participants. This suggests that cooperative and interactive contexts in team sports are more effective in developing mental adaptability.

T-Test Results for Frequency of Sports Activity Practice on Mental Flexibility:

Table 10

T-Test Results for Frequency of Sports Activity Practice on Mental Flexibility

Monthly Practice Frequency	N	Mean	Std. Dev	t calc	Sig. Level	Stat. Sig
Less than 3 times	86	25.13	6.60	–30.18	0.000	Statistically Significant
3 times and more	114	46.18	3.00			

Source: Researcher using IBM SPSS Statistics 25.

Table 10: Students who practiced sports three times or more per month achieved significantly higher flexibility scores compared to those who practiced less frequently, indicating that regularity of practice plays a crucial role in developing this competence.

T-Test Results for Years of Sports Activity Practice on Mental Flexibility:

Table 11

T-Test Results for Years of Sports Activity Practice on Mental Flexibility

Years of Practice	N	Mean	Std. Dev	t calc	Sig. Level	Stat. Sig
Less than one year	71	23.76	3.53	–28.38	0.000	Statistically Significant
More than one year	129	44.48	6.79			

Source: Researcher using IBM SPSS Statistics 25.

Table 11: Students with more than one year of continuous sports practice showed much higher flexibility levels compared to those with shorter practice. This confirms that long-term engagement contributes to cumulative benefits in adaptability and problem-solving skills.

The general hypothesis states that there are statistically significant differences in the level of mental flexibility between secondary school students who practice and those who do not practice school sports activities.

Based on the results from tables the majority of scientific studies agree with our research findings on the significant role of sports activity in developing mental and cognitive skills, particularly mental flexibility and the ability to adapt and make quick decisions. The study by Ibrahim and Hikmat (2016) confirms these results, revealing that sports practitioners enjoy higher levels of mental alertness compared to non-practitioners, indicating a strong correlation between sports practice and the development of mental flexibility (Clemente-Suárez et al., 024).

In the same context, the study by Abdul-Masih and Asi (2023) demonstrated that female students practicing sports activities showed higher levels of mental flexibility compared to their non-practicing counterparts. However, some studies indicate variations in the degree of this impact based on multiple factors, including the type of sports exercises and training level, where certain sports emerge as more effective in developing mental skills than others (Shi et al., 2024).

Other studies suggest that mental flexibility may be influenced by additional factors beyond sports practice, such as the surrounding social environment and the level of psychological support available to the individual. These findings have strong theoretical support in mental flexibility theory, which emphasizes that continuous confrontation with challenges – as occurs in the sports field – develops an individual's ability to adapt to various changes. They are also supported by social learning theory, which highlights how participation in sports activities contributes to developing critical thinking skills and the ability to modify strategies according to the requirements of varying situations.

The first hypothesis states that there are statistically significant differences in the level of mental flexibility between secondary school students practicing team sports activities and those practicing individual sports activities.

Based on the results from tables, these findings agree with numerous studies indicating that team activities improve mental flexibility due to continuous interaction with colleagues and dealing with diverse playing strategies, which develops the ability to adapt and think quickly. The study by Aslan (2018) indicated that team sports players possess higher levels of mental flexibility compared to individual sports players, suggesting that individual sports contribute to developing problem-solving skills independently – a different type of mental flexibility compared to that resulting from team sports. The impact of individual sports on mental flexibility tends to be higher among individuals who possess high levels of self-motivation compared to those who rely on group motivation (Huang et al., 2024).

The second hypothesis states that there are statistically significant differences in the level of mental flexibility between secondary school students who practice sports activities regularly and those who practice them irregularly.

Based on the results from tables, these findings align with most studies confirming that continuity in sports practice contributes to improving mental performance and mental flexibility, as repetition creates more flexible thinking patterns when facing challenges. This was confirmed by (Caponnetto et al., 2021), which showed that athletes who practiced training regularly demonstrated clear improvement in mental flexibility levels. However, some research indicates that other factors may influence mental flexibility even if an individual practices sports regularly, such as training quality, psychological support, and previous experiences. Regular sports practice may not have the same impact on everyone, as some individuals may develop mental flexibility through other activities such as reading and continuous learning (Passarello et al., 2022).

The third hypothesis states that there are statistically significant differences in the level of mental flexibility between secondary school students who practice school sports activities for a long period and those who practice them for a short period.

Based on the results from tables, these findings agree with studies supporting that long-term practice develops cognitive abilities more significantly compared to short-term practice (Gizzonio et al., 2022). it was found that participants who underwent long-term training were more capable of adapting to mental challenges compared to participants who trained for short periods. However, some individuals may experience different effects from long-term practice, as other factors such as mental readiness and personal motivation may play a role in determining the extent to which practice duration affects mental flexibility.

CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH

This study demonstrates that school-based physical activity plays a pivotal role in developing cognitive flexibility among Algerian secondary education students. The findings revealed statistically significant differences between students who participate in sports activities and those who do not, favoring the physically active group. Furthermore, the type of physical activity significantly influences cognitive flexibility levels, with students engaged in team sports demonstrating superior performance compared to their counterparts practicing individual sports. Regular participation and longer duration of engagement were also associated with higher levels of adaptability, problem-solving skills, and creativity. These results align with previous studies that emphasize the positive role of sports in improving both psychological and cognitive health.

At the same time, the study highlights the importance of effectively integrating physical activity into the educational curriculum, not only to improve physical fitness but also to foster cognitive and social development. Diversifying school sports programs – particularly by strengthening team sports – can enhance cooperation, adaptability, and resilience among students.

While this study provides valuable insights into the relationship between school-based physical activity and mental flexibility among secondary education students, several limitations should be acknowledged. The research focused primarily on general categories of individual versus team sports without examining specific sport types in detail, and the cross-sectional design limits causal inferences about long-term effects. Environmental and contextual factors that may influence mental flexibility development were not comprehensively explored, which may limit the generalizability of findings to other educational levels and cultural contexts. Future research should address these limitations through longitudinal studies to establish causal relationships between sustained physical activity and mental flexibility development, detailed investigations into specific sport types including cognitive sports such as chess, and examination of multifactorial influences including family environment, teaching methodologies, and technology integration. Additionally, intervention studies targeting non-participating students, research on optimal pedagogical integration of physical activity with mental flexibility skill development, and broader population studies extending to primary education and diverse cultural contexts would contribute to a more comprehensive understanding of the mechanisms underlying the relationship between physical activity and mental flexibility, ultimately informing evidence-based practices in physical education and sports pedagogy.

This study provides comprehensive recommendations for enhancing mental flexibility through structured physical activity programs across five key areas. Institutionally, schools should integrate physical activity as a core curriculum component

while establishing policies that emphasize sports' cognitive and psychological benefits through inclusive participation. Pedagogically, educators should implement team-based cooperative learning models, incorporate reflective practices, and combine sports with decision-making tasks to maximize cognitive development. Infrastructure requirements include providing safe facilities, training physical education teachers in cognitive development principles, and fostering interdisciplinary collaboration between departments. Community engagement involves partnering with local sports organizations, educating families about sports' cognitive benefits, and organizing school-community events. Finally, student motivation strategies focus on allowing activity choice based on individual interests, recognizing effort over performance, and utilizing peer mentorship to sustain participation, creating a holistic approach that leverages physical activity's potential to develop cognitive flexibility in educational settings.

Future research should not only expand to different regions and educational levels within Algeria but also conduct comparative studies with other countries. Such cross-national analyses could provide a deeper understanding of how cultural, educational, and institutional contexts influence the relationship between school sports participation and mental flexibility. Longitudinal and mixed-method designs are recommended to capture both the long-term impact of sports involvement and the underlying mechanisms that support students' cognitive and psychological development.

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