© 2026 International Conference on Multidisciplinary Sciences and Innovations . All Rights Reserved.

MENTAL PERFORMANCE AND SLEEP QUALITY AS HYGIENIC INDICATORS OF ADOLESCENTS' FUNCTIONAL STATE IN HYBRID LEARNING

Ataullayeva Marjonabonu Sanjar qizi
https://orcid.org/0009-0003-9022-8470
marjonabonu_ataullayeva@bsmi.uz
Bukhara State Medical Institute, Bukhara, Uzbekistan
Odilov Shokhruz Beshimovich
https://orcid.org/0009-0007-9422-9760
Shokhruz.odilov14@gmail.com
Bukhara State Medical Institute, Bukhara, Uzbekistan
Odilova Mekhronabonu Beshimovna
https://orcid.org/0009-0005-7690-5409
melonaodilova@gmail.com
Bukhara State Medical Institute, Bukhara, Uzbekistan
https://doi.org/10.5281/zenodo.22880901

Abstract. Hybrid learning changes both the intensity of adolescents' digital exposure and the organization of their daily routine. Sleep and cognitive performance are among the most sensitive functional indicators of these changes. A study of 4,068 adolescents demonstrated significant differences in sleep and perceived academic well-being across in-person, hybrid and online instructional formats. A recent umbrella review combining 127 primary studies and 867,003 participants also identified consistent associations between digital-device exposure and shorter sleep duration, delayed bedtime and poorer sleep quality. Cognitive studies indicate that excessive and unstructured screen exposure is associated with poorer attention and working-memory performance.

Keywords: adolescents, hybrid learning, mental performance, sleep quality, screen time, cognitive function, digital load, school hygiene.

УМСТВЕННАЯ РАБОТОСПОСОБНОСТЬ И КАЧЕСТВО СНА КАК ГИГИЕНИЧЕСКИЕ ПОКАЗАТЕЛИ ФУНКЦИОНАЛЬНОГО СОСТОЯНИЯ ПОДРОСТКОВ ПРИ ГИБРИДНОМ ОБУЧЕНИИ

Атауллаева Маржонабону Санжар кизи
https://orcid.org/0009-0003-9022-8470
marjonabonu_ataullayeva@bsmi.uz
Бухарский государственный медицинский институт, Бухара, Узбекистан
Одилов Шохруз Бешимович
https://orcid.org/0009-0007-9422-9760
Shokhruz.odilov14@gmail.com
Бухарский государственный медицинский институт, Бухара, Узбекистан
Одилова Мехронабону Бешимовна
https://orcid.org/0009-0005-7690-5409
melonaodilova@gmail.com
Бухарский государственный медицинский институт, Бухара, Узбекистан

© 2026 International Conference on Multidisciplinary Sciences and Innovations . All Rights Reserved.

Аннотация. Гибридное обучение изменяет как интенсивность цифровой нагрузки подростков, так и организацию их повседневного режима. Сон и умственная работоспособность относятся к наиболее чувствительным функциональным показателям этих изменений. В исследовании, включавшем 4068 подростков, были выявлены значимые различия в характеристиках сна и субъективно оцениваемом академическом благополучии при очном, гибридном и онлайн-форматах обучения. Недавний зонтичный обзор, объединивший 127 первичных исследований и 867 003 участника, также выявил устойчивую связь использования цифровых устройств с сокращением продолжительности сна, более поздним отходом ко сну и ухудшением его качества. Исследования когнитивных функций показывают, что чрезмерная и недостаточно структурированная экранная нагрузка связана с ухудшением внимания и рабочей памяти.

Ключевые слова: подростки, гибридное обучение, умственная работоспособность, качество сна, экранное время, когнитивные функции, цифровая нагрузка, школьная гигиена.

Relevance. Hybrid education combines classroom lessons with electronic platforms, online assignments, digital communication and independent screen-based work. This format changes the traditional structure of the school day: cognitive load may continue after classroom instruction, while educational screen exposure is added to recreational use of smartphones and other digital devices. Sleep deserves particular attention because adolescence is accompanied by physiological changes in sleep timing, while early school schedules and evening digital activity can further restrict recovery. Cognitive performance is closely related to the adequacy of this recovery. For hygienic assessment, sleep duration alone is insufficient; sleep regularity, timing, disturbances and evening digital exposure should also be considered

Objective. To evaluate current evidence on the relationship between digital and hybrid learning, sleep characteristics and cognitive performance in adolescents and to determine their value as indicators for hygienic monitoring.

Materials and Methods. Contemporary studies examining instructional format, digital exposure, sleep and cognitive functioning in adolescents were analytically compared. Priority was given to studies with large samples, longitudinal observations, objective or standardized cognitive measures and quantitative assessment of digital behavior. Particular attention was paid to differences between educational and recreational screen exposure and between daytime and evening device use.

Discussion. Saletin et al. assessed 4,068 adolescents and demonstrated that instructional format was associated with differences in sleep characteristics and perceived academic well-being. More stable and less disturbed sleep was associated with better cognitive functioning, stronger school connectedness and lower academic stress [1]. Hybrid and online formats could provide more time for sleep because of later wake times, although greater sleep opportunity did not always correspond to better functional recovery.

The importance of digital exposure was also confirmed in an umbrella review including 127 primary studies and 867,003 adolescents. Greater use of digital devices was associated with shorter sleep duration, delayed bedtime and poorer sleep quality. The strongest associations were observed for evening smartphone, Internet and social-media use [2].

Cognitive studies show that excessive and poorly structured screen exposure may be associated with reduced attention and working-memory performance. The relationship depends on the type of digital activity, duration of uninterrupted work and the degree of multitasking. Educational use of digital devices therefore should not be assessed in the same way as recreational or fragmented screen activity [3,4].

© 2026 International Conference on Multidisciplinary Sciences and Innovations . All Rights Reserved.

These data indicate that hygienic monitoring of adolescents in hybrid education should include not only total screen time, but also uninterrupted digital work, evening exposure, sleep duration and regularity, subjective fatigue, attention stability and working-memory performance.

Conclusion. It was established that sleep characteristics and mental performance are closely related indicators of adolescents' functional state under conditions of hybrid and digital learning. More stable sleep is associated with better cognitive functioning and academic well-being, whereas intensive and especially evening digital exposure is associated with delayed sleep onset, shorter sleep duration and poorer sleep quality. It was determined that total screen time alone does not adequately characterize functional risk. The timing and content of digital activity, duration of uninterrupted screen work, sleep regularity, attention and working-memory performance should also be included in hygienic assessment. Recent cognitive data indicate that greater and poorly structured screen exposure is associated with poorer attention and working-memory performance and shorter nocturnal sleep.

References

1. Saletin J.M., Wolfson A.R., Wahlstrom K.L., Honaker S.M., Owens J.A., Seixas A.A., Wong P., Carskadon M.A., Meltzer L.J. Instructional approach, sleep, and perceived academic well-being in adolescents during COVID-19: Evidence from the NESTED study // Sleep Health. – 2024. – Vol. 10, No. 4. – P. 485–492. doi:10.1016/j.sleh.2024.04.006.
2. Fiore M., Arena D., Crisafi V., Grieco V., Palella M., Timperanza C., Conti A., Cuffari G., Ferrante M. Digital Devices Use and Sleep in Adolescents: An Umbrella Review // International Journal of Environmental Research and Public Health. – 2025. – Vol. 22, No. 10. – Art. 1517. doi:10.3390/ijerph22101517.
3. Burnell K. Daily links between objective smartphone use and sleep among adolescents // Journal of Adolescence. – 2024. – Vol. 96, No. 6. – P. 1171–1181. doi:10.1002/jad.12326.
4. Toth C., Osser B., Bondar L.I., Fazakas R., Marcu F.M., Pascalau N.A., Suciu R.N., Dogaru B.G. Associations Between Screen Time, Sleep, and Executive Function in School-Aged Children and Adolescents: The Moderating Role of Digital Content and Age // Journal of Clinical Medicine. – 2025. – Vol. 14, No. 24. – Art. 8842. doi:10.3390/jcm14248842.