

# The Influence of Using Audio-Visual Media on Learning Outcomes of 2012 SKJ Gymnastics on Body Flexibility and Balance

Suharti<sup>1</sup>, Ismawandi BP<sup>2</sup>, Wawan Gunawan<sup>3</sup>

<sup>1</sup>Universitas PGRI AdiBuana, Surabaya, Indonesia, 60234

<sup>2</sup>Universitas PGRI AdiBuana, Surabaya, Indonesia, 60234

<sup>3</sup>Universitas PGRI AdiBuana, Surabaya, Indonesia, 60234

## ABSTRACT

This study aims to determine the increase in the ability to perform flexibility and body balance through the SKJ 2012 exercise by utilizing audio-visual media for physical education students at PGRI Adibuana University Surabaya. The research method used is action research. The data as a whole is in the form of quantitative data that is analyzed descriptively. There is an increase in learning outcomes of the 2012 SKJ gymnastics on flexibility and balance. The data in the pre-flexibility cycle showed the lowest value of 30.00 and the highest value of 38.00, with an average value of 34.36, the standard deviation value of 2.47, while the results of cycle one flexibility showed the lowest value of 33.00 and the highest value of 48.00, with an average value of 40.27, the standard deviation value of 4.10, with a sample size of 11 people. The increase in body flexibility results from pre-cycle to cycle 1 was 17.20%. The pre-balance cycle results show the lowest value of 8.00 and the highest value of 22.00, with an average value of 13.55, a standard deviation of 4.50. In contrast, the balance cycle 1 shows the lowest value of 11.00 and the highest value of 24.00, with an average value of 16.45, a standard deviation of 5.03, with the number of samples is 11 people. The increase in the balance of the body from pre-cycle to cycle 1 is 21.48%.

**Keywords:** Gymnastics SKJ 12, Flexibility, Balance, Audio Visual

## Introduction

In teaching and learning interactions, the ideal is a synergistic and effective situation between lecturers and students. This will harmonize good teaching and learning interactions so that students can get examples of right exercise movements and do them in a relatively fast time. Students' mobility can be increased effectively if students can follow and be serious in learning and doing the 2012 SKJ movement (Djaafar et al., 2019; Fitria, Pujiastuti, & Mulyantoro, 2019; T. et al., 2019).

The current situation, when students learn SKJ 2012 gymnastics, lecturers experience several obstacles in delivering motion samples and monitoring student movement exercises, in a class that has many people and things that are not easy for lecturers to show examples of motion and tracking personally and aim at motion training for a relatively short duration of time (Desi & Firmansyah, 2018; Mandalawati, 2016; Soraya, 2017).

The implementation of the 2012 SKJ has not met the standards of sufficient understanding for students, especially in movements that follow the rhythm. It can be said that it has not successfully understood and trained the 2012 SKJ gymnastics movements. Students experience many obstacles including; (1) experiencing difficulties in understanding the actions, (2) the teaching method is more lecturer-centred, (3) limited facilities and infrastructure, namely a sound system and a DVD player, (4) limited time so that not all students can do exercises (Suharti, Nurhasan, & Wiriawan, 2019).

Suppose this problem is not resolved or given a treatment method. In that case, there will be very few movements mastered by students. Even students will tend not to be motivated to memorize and carry out these gymnastic movements. Students may grow to be inactive in the learning process because gymnastics is an exciting body movement activity in optimizing student growth and development. Gymnastics movements are very suitable for muscle strength, muscle endurance, agility, speed, heart rate from all parts of the body (Selfi, Simbolon, & Kusdalinah, 2018; Sojourner, Burgasser, & Weise, 2018). Besides, gymnastics also has the potential to develop fundamental movement skills and a tool to measure students' health and freshness. More importantly, gymnastics can improve flexibility and balance for anyone who does it, even if they have to repeat individual exercise movements dozens of times (Al-Mashhadi, 2019; Br Karo & Kaban, 2019; Sobko, Koliesov, & Ulaeva, 2019).

Thus learning in the classroom is influenced by creative lecturers, namely lecturers who seek ways and try to engage students directly and pleasantly without using coercive techniques (Cuberek et al., 2013; Lindgren & Barker, 2019; Walters, Silva, & Nikolai, 2017). In the world of education, learning activities carried out by students need to be endeavoured to achieve optimal results and to follow their objectives.

According to previous researchers, a trainer rarely uses audio-visual media in the 2012 SKJ gymnastics learning process (Budhyani, Angendari, & Sudirtha, 2020; Novita, Sukmanasa, & Pratama, 2019). The use of audio-visual learning methods is a medium that rests on the senses of hearing and sight (Parapat, 2020; Resnani, 2019). In connection with this, the researcher wants to provide a teaching and learning process through audio-visual,

hoping that the learning process through audio-visual can increase enthusiasm and student learning outcomes. According to Gunawan W, Degeng INS, Utaya S (2019) learning outcomes are abilities possessed by each student after receiving their learning experience. Learning outcomes are the students' results from the learning process, which appears in changes in overall behaviour consisting of cognitive, affective, and psychomotor elements (Alonso, Pastor, Alvarez, Suarez, & Tasic, 2017; Ow Yong & Cameron, 2019).

## **Method**

The research method used in this study is a classroom action research. Classroom action research examines learning activities in the form of an action deliberately raised and occurs in a class simultaneously (Mertler, 2017; Rose & Grosvenor, 2013). These actions are given by the lecturer or by the lecturers' directions by the students. In the research procedures book in a practical approach, defining classroom action research is quite simple. Namely, it is an examination of activities that are deliberately raised and occur in a class (C. E. S. Hong, 2011; Purohman, 2018; Rose & Grosvenor, 2013). Classroom action research is a research that is systematically reflective of lecturers' various actions as researchers, from the beginning of the planning to the end of the real action assessment in the classroom in the form of teaching and learning activities, to improve the learning conditions. (Bell & Aldridge, 2014; C. E. S. Hong, 2011; Sumarni, Wardani, Sudarmin, & Gupitasari, 2016). The implementation of Classroom Action Research serves to enhance the quality of education or teaching organized by lecturers or researchers themselves, the impact of which is expected to be no more problems in class. The study population was students of 2018 B Sports Coaching Education, Universitas PGRI Adi Buana. This research was conducted at Gelora Hasta Brata Universitas PGRI Adi Buana Jl. Hamlet Menanggal XII Surabaya. The time required to carry out this research is two months or eight weeks, which is scheduled in a week there are three exercises, namely Monday, Wednesday and Friday. The research instrument to determine the balance using the balance beam test while determining flexibility using the seat and reach test.

## **Result**

Based on what has been discussed previously, audio visual is a learning medium that can improve learning outcomes, educative, and instructional. The descriptions of the results

of the 2012 SKJ gymnastics exercises in pre-cycle and cycle one on flexibility and balance are as follows:

Table 5.1. The results of pre-cycle and cycle one flexibility and balance

Variable	Group	Test	N	Min	Max	Mean	SD	Enhancement
flexibility	SKJ 2012	Pre	11	30.00	38.00	34.36	2.47	17.20%
		Post	11	33.00	48.00	40.27	4.10	
balance	SKJ 2012	Pre	11	8.00	22.00	13.55	4.50	21.48%
		Post	11	11.00	24.00	16.45	5.03	

In the table above, the pre-flexibility cycle results show the lowest value of 30.00 and the highest value of 38.00, with an average value of 34.36, the standard deviation value of 2.47. In contrast, the results of cycle one flexibility show the lowest value of 33.00 and the highest value of 48.00, with an average value of 40.27, the standard deviation value 4.10, with a sample size of 11 people. The increase from pre-cycle to cycle 1 was 17.20%.

The pre-balance cycle results show the lowest value of 8.00 and the highest value of 22.00, with an average value of 13.55, a standard deviation of 4.50. In contrast, the balance cycle 1 shows the lowest value of 11.00 and the highest value of 24.00, with an average value of 16.45, a standard deviation of 5.03, with the number of samples is 11 people. The increase from pre-cycle to cycle 1 was 21.48%.

## Discussion

Gymnastics' benefits are aimed at increasing joint flexibility and flexibility, improving the attitude and beauty of movement, and improving body health (Hsieh, Lin, Chang, Huang, & Hung, 2017; Yarchikovskaya, Koval, Lukina, & Ustinova, 2017). Another opinion is that regular exercise strengthens the skeletomuscular system by increasing joints and muscles (Ren et al., 2020; Silva et al., 2020; Yarchikovskaya et al., 2017). This is reinforced by the research results conducted by (Micheo, Baerga, & Miranda, 2012), which states that flexibility is needed when doing activities, besides that the 2012 SKJ exercise can improve one's fitness (Halabchi, Alizadeh, Sahraian, & Abolhasani, 2017; Nuzzo, 2020; Themanson, Pontifex, & Hillman, 2008).

Two things are closely related to flexibility, namely flexibility (Y. Hong, Li, & Robinson, 2000; Kloubec, 2010). Flexibility is closely related to flexibility between bones and joints, while flexibility is closely related to the state of flexibility between the level of elasticity of muscles, tendons, and ligaments. Suppose a person has these two elements (flexibility). In that case, it will guarantee the extent of motion (amplitude) in the joints and make it easier for muscles, tendons and ligaments, and joints to move. Someone who wants to have high flexibility must know two things related to each other, namely, flexibility (Coubard, Duretz, Lefebvre, Lapalus, & Ferrufino, 2011; Micheo et al., 2012).

Flexibility is closely related to flexibility between bones and joints (De Villa, Martin, & Dominguez, 2020; Liu, 2018; Sobrin, Stone, Huang, Niles, & Nazarian, 2020). In contrast, flexibility is closely related to the state of flexibility between the level of elasticity of muscles, tendons, ligaments and joints during movement (Ezugwu et al., 2020; Ge, Alnaif, Azzi, & Zadeh, 2018). Quality of life can be improved by increasing and maintaining a good range of motion in the joints. Loss of flexibility can be a factor in physical problems such as pain syndrome or balance disorders. Many factors are considered when building body flexibility, including joint structure, ligaments, tendons, muscles, fat tissue, body temperature, age, and gender (Nassib, Mkaouer, Riahi, Wali, & Nassib, 2020; Wärtsilä & Energy Exemplar, 2012). Besides, that flexibility can be a determining factor in performing skills performance (Schulze, Sljoka, & Whiteley, 2014; Zhang, Wang, Lu, Wang, & Wang, 2020).

Physical Fitness Exercise 2012, which is done regularly, is proven to improve balance (Donnelly et al., 2016; Lavie, Ozemek, Carbone, Katzmarzyk, & Blair, 2019). The increased proportion is caused by the movements that are in physical fitness to support balance. Nassib et al., (2020); Zhang et al., (2020) explain that physical exercise done correctly will maintain balance in the body for a certain period. These findings are in line with the results of research from (Nassib et al., 2020; Pozuelo-Carrascosa et al., 2020) that rhythmic exercise programs facilitate a significant increase in the dynamic balance ability of deaf children. Balance integrates sensory input from various sources (vestibular, kinesthetic, tactile and visual) to plan and implement static and dynamic positions (Park & Bae, 2020; Taborri, Salvatori, Mariani, Rossi, & Patane, 2020).

The movements in 2012 physical fitness exercises that support balance include standing upright, lifting one leg, moving steps quickly, jumping, jumping, and coordination. Balance requires elements of coordination, agility, and agility (Ali, 2020; Hammami,

Duncan, Nebigh, Werfelli, & Rebai, 2020; Park & Bae, 2020). In the pre-cycle exercise of 2012 SKJ gymnastics through audio-visual media, the ability to perform flexibility and balance has not been able to show maximum results due to the absence of routine exercises and no guidance by lecturers. In cycle 1, after periodic training and guidance carried out continuously by the lecturer, the student's ability to exercise flexibility and balance showed significantly increased results (Leon et al., 2020; Stokes et al., 2020).

## Conclusion

This study concludes that through audio-visual media learning, physical fitness 2012 affects increasing flexibility and body balance. In the flexibility, the average value in pre-cycle is 34.36. In cycle one is 40.27, with the average value obtained from pre-cycle to process one, the ability to perform flexibility has increased by 17.20%. In the balance, the average value in pre-cycle is 13.55, and in cycle one is 16.45, with the average value obtained from pre-cycle to cycle one the ability to balance has increased by 17.20%.

## Acknowledgement

On this occasion, we would like to thank the research funding assistance from the LPPM, Physical Education Study Program, Postgraduate School of PGRI Adi Buana University, Surabaya.

## References

- Al-Mashhadi, R. A. A. (2019). Social desire and physical psychological manifestations and their relationship to the performance of artistic gymnastics skills. *Journal of Physical Education (Maringa)*. <https://doi.org/10.4025/jphyseduc.v30i1.3038>
- Ali, S. M. (2020). The effect of 6-weeks of practicing balance exercises on developing agility for youth tennis players. *International Journal of Psychosocial Rehabilitation*.
- Alonso, D., Pastor, J., Alvarez, B., Suarez, T., & Tasic, I. (2017). Improving the learning experience and outcomes in entrepreneurial courses. *IEEE International Symposium on Industrial Electronics*. <https://doi.org/10.1109/ISIE.2017.8001482>
- Bell, L. M., & Aldridge, J. M. (2014). Student voice, teacher action research and classroom improvement. In *Student Voice, Teacher Action Research and Classroom Improvement*. <https://doi.org/10.1007/978-94-6209-776-6>
- Br Karo, E. I., & Kaban, F. O. (2019). Optimalisasi Tumbuh Kembang Bayi Melalui Edukasi, Terapi Pijat Bayi (Baby Massage) dan Senam Bayi (Baby Gym) Di Klinik Bersalin Kota Medan dan Kabupaten Deli Serdang Tahun 2018. *Jurnal Riset Hesti Medan Akper Kesdam I/BB Medan*. <https://doi.org/10.34008/jurhesti.v4i1.60>
- Budhyani, I. D. A. M., Angendari, M. D., & Sudirtha, I. G. (2020). The effectiveness of using

- audio-visual media to improve student's self-efficacy in fashion design course. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/1516/1/012055>
- Coubard, O. A., Duretz, S., Lefebvre, V., Lapalus, P., & Ferrufino, L. (2011). Practice of contemporary dance improves cognitive flexibility in aging. *Frontiers in Aging Neuroscience*. <https://doi.org/10.3389/fnagi.2011.00013>
- Cuberek, R., Chmelík, F., Frömel, K., Mitáš, J., Vašíčková, J., & Svozil, Z. (2013). The Concept of the Implementation of Present Evidence-based Knowledge and Technology into the Preparation of Sport Professionals. *Procedia - Social and Behavioral Sciences*. <https://doi.org/10.1016/j.sbspro.2013.06.075>
- De Villa, S. G., Martin, A. J., & Dominguez, J. J. G. (2020). Adaptive IMU-based Calibration of the Center of Joints for Movement Analysis: One Case Study. *IEEE Medical Measurements and Applications, MeMeA 2020 - Conference Proceedings*. <https://doi.org/10.1109/MeMeA49120.2020.9137135>
- Desi, H., & Firmansyah. (2018). Pengaruh Senam Kesegaran Jasmani (SKJ) Terhadap Penurunan Kadar Gula Darah Pada Penderita Diabetes Mellitus Di Puskesmas Nambo Kota Kendari. *Jurnal MJPH*.
- Development of Audio Visual Learning Media Using Professional Adobe Flash CS6 in Physical Education in Sport and Health. (2020). *Journal Of Xi'an University of Architecture & Technology*. <https://doi.org/10.37896/jxat12.05/1719>
- Djaafar, T., Hadisaputro, S., Widjanarko, B., Pemayun, T. G. D., Susanto, H., Rahayu, T., & Soegiyanto, K. S. (2019). The effects of physical fitness gymnastics (SKJ) 2012 towards body mass index, body fat percentage, and physical fitness in obese children. *International Journal of Pharmaceutical Research*. <https://doi.org/10.31838/ijpr/2019.11.02.043>
- Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., ... Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Medicine and Science in Sports and Exercise*. <https://doi.org/10.1249/MSS.0000000000000901>
- Ezugwu, U. A., Egba, E. N., Igweagu, P. C., Eneje, L. E., Orji, S., & Ugwu, U. C. (2020). Awareness of Awkward Posture and Repetitive Motion as Ergonomic Factors Associated With Musculoskeletal Disorders by Health Promotion Professionals. *Global Journal of Health Science*. <https://doi.org/10.5539/gjhs.v12n6p128>
- Fitria, S., Pujiastuti, S. E., & Mulyantoro, D. K. (2019). Implementation of Reproductive Health Gymnastics against Female Adolescents Hemoglobin Level. *E3S Web of Conferences*. <https://doi.org/10.1051/e3sconf/201912504005>
- Ge, S. M., Alnaif, N., Azzi, A. J., & Zadeh, T. (2018). Ligaments vs tendons in joint reconstruction: A review of histology and biomechanics. *Muscles, Ligaments and Tendons Journal*. <https://doi.org/10.11138/mltj/2018.8.2.246>
- Gunawan W, Degeng INS, Utaya S, S. (2019). The Improvement of Conceptual and Procedural Understanding by Scaffolding with Responsiveness. *International Journal of Innovation, Creativity and Change*, 7(5), 162–179. Retrieved from [https://ijicc.net/images/vol7iss5/7517\\_Gunawan\\_2019\\_E\\_R.pdf](https://ijicc.net/images/vol7iss5/7517_Gunawan_2019_E_R.pdf)
- Halabchi, F., Alizadeh, Z., Sahraian, M. A., & Abolhasani, M. (2017). Exercise prescription for patients with multiple sclerosis; potential benefits and practical recommendations.

*BMC Neurology*. <https://doi.org/10.1186/s12883-017-0960-9>

- Hammami, R., Duncan, M. J., Nebigh, A., Werfelli, H., & Rebai, H. (2020). The Effects of 6 Weeks Eccentric Training on Speed, Dynamic Balance, Muscle Strength, Power, and Lower Limb Asymmetry in Prepubescent Weightlifters. *Journal of Strength and Conditioning Research*. <https://doi.org/10.1519/jsc.0000000000003598>
- Hong, C. E. S. (2011). Action Research in Teacher Education: Classroom Inquiry, Reflection, and Data-Driven Decision Making. *Journal of Inquiry and Action in Education*.
- Hong, Y., Li, J. X., & Robinson, P. D. (2000). Balance control, flexibility, and cardiorespiratory fitness among older Tai Chi practitioners. *British Journal of Sports Medicine*. <https://doi.org/10.1136/bjsm.34.1.29>
- Hsieh, S. S., Lin, C. C., Chang, Y. K., Huang, C. J., & Hung, T. M. (2017). Effects of Childhood Gymnastics Program on Spatial Working Memory. *Medicine and Science in Sports and Exercise*. <https://doi.org/10.1249/MSS.0000000000001399>
- Kloubec, J. A. (2010). Pilates for improvement of muscle endurance, flexibility, balance, and posture. *Journal of Strength and Conditioning Research*. <https://doi.org/10.1519/JSC.0b013e3181c277a6>
- Lavie, C. J., Ozemek, C., Carbone, S., Katzmarzyk, P. T., & Blair, S. N. (2019). Sedentary Behavior, Exercise, and Cardiovascular Health. *Circulation Research*. <https://doi.org/10.1161/CIRCRESAHA.118.312669>
- Leon, N., Balakrishna, Y., Hohlfeld, A., Odendaal, W. A., Schmidt, B. M., Zweigenthal, V., ... Daniels, K. (2020). Routine Health Information System (RHIS) improvements for strengthened health system management. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD012012.pub2>
- Lindgren, R., & Barker, D. (2019). Implementing the Movement-Oriented Practising Model (MPM) in physical education: empirical findings focusing on student learning. *Physical Education and Sport Pedagogy*. <https://doi.org/10.1080/17408989.2019.1635106>
- Liu, L. (2018). Biomechanical analysis on the stop-jump action of patients with knee joint injury. *International Journal Bioautomation*. <https://doi.org/10.7546/ijba.2018.22.1.49-56>
- Mandalawati, T. K. (2016). Penerapan Video Senam Kesegaran Jasmani 2012 Untuk Meningkatkan Gerakan Senam Kesegaran Jasmani Siswa Kelas V Sd Negeri 1 Panggung Barat Magetan. *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*. <https://doi.org/10.25273/pe.v3i02.279>
- Mertler, C. A. (2017). Action Research: Teachers as Researchers in the Classroom. *The Modern Language Journal*.
- Micheo, W., Baerga, L., & Miranda, G. (2012). Basic principles regarding strength, flexibility, and stability exercises. *PM and R*. <https://doi.org/10.1016/j.pmrj.2012.09.583>
- Nassib, S. H., Mkaouer, B., Riahi, S. H., Wali, S. M., & Nassib, S. (2020). Prediction of Gymnastics Physical Profile Through an International Program Evaluation in Women Artistic Gymnastics. *Journal of Strength and Conditioning Research*. <https://doi.org/10.1519/JSC.0000000000001902>
- Novita, L., Sukmanasa, E., & Pratama, M. Y. (2019). Penggunaan Media Pembelajaran Video terhadap Hasil Belajar Siswa SD. *Indonesian Journal of Primary Education*



### Penggunaan.

- Nuzzo, J. L. (2020). The Case for Retiring Flexibility as a Major Component of Physical Fitness. *Sports Medicine*. <https://doi.org/10.1007/s40279-019-01248-w>
- Ow Yong, L. M., & Cameron, A. (2019). Learning from elsewhere: Integrated care development in Singapore. *Health Policy*. <https://doi.org/10.1016/j.healthpol.2018.12.004>
- Parapat, N. (2020). Pengaruh Penggunaan Media Audio Visual Terhadap Hasil Belajar Kelas XII N 1 Sipahutar T.P 2019/ 2020. *Areopagus : Jurnal Pendidikan Dan Teologi Kristen*. <https://doi.org/10.46965/ja.v18i1.41>
- Park, Y., & Bae, Y. (2020). Brake time is correlated with lower extremity strength, dynamic balance and low-contrast sensitivity in unpredictable driving situations in elderly drivers compared with young drivers: A cross-sectional study. *Geriatrics and Gerontology International*. <https://doi.org/10.1111/ggi.13915>
- Pozuelo-Carrascosa, D. P., Carmona-Torres, J. M., Laredo-Aguilera, J. A., Latorre-Román, P. Á., Párraga-Montilla, J. A., & Cobo-Cuenca, A. I. (2020). Effectiveness of respiratory muscle training for pulmonary function and walking ability in patients with stroke: A systematic review with meta-analysis. *International Journal of Environmental Research and Public Health*. <https://doi.org/10.3390/ijerph17155356>
- Purohman, S. P. (2018). Classroom Action Research Alternative Research Activity for Teachers. *Research Gate*.
- Ren, X., An, P., Bekker, T., Chen, Y., Khot, R. A., Ten Bhömer, M., ... Spina, G. (2020). Weaving healthy behaviors into new technology routines: Designing in (and for) the COVID-19 work-from-home period. *DIS 2020 Companion - Companion Publication of the 2020 ACM Designing Interactive Systems Conference*. <https://doi.org/10.1145/3393914.3395911>
- Resnani, R. (2019). Penerapan Model Pembelajaran Kooperatif dengan Media Audio Visual Berbasis Teknologi Untuk Meningkatkan Aktivitas dan Kemampuan Menyimak Mahasiswa. *Jurnal PGSD*. <https://doi.org/10.33369/pgsd.12.2.141-149>
- Rose, R., & Grosvenor, I. (2013). Action research. In *Doing Research in Special Education: Ideas into Practice*. <https://doi.org/10.4324/9781315069173-8>
- Schulze, B., Slijoka, A., & Whiteley, W. (2014). How does symmetry impact the flexibility of proteins? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*. <https://doi.org/10.1098/rsta.2012.0041>
- Selfi, B. F., Simbolon, D., & Kusdalinah, K. (2018). Pengaruh Edukasi Pola Makan dan Senam terhadap Kadar Gula Darah Pada Penderita DM Tipe 2. *Jurnal Kesehatan*. <https://doi.org/10.26630/jk.v9i2.948>
- Silva, F. C. da, Iop, R. da R., Andrade, A., Costa, V. P., Gutierrez Filho, P. J. B., & Silva, R. da. (2020). Effects of Physical Exercise on the Expression of MicroRNAs: A Systematic Review. *Journal of Strength and Conditioning Research*. <https://doi.org/10.1519/JSC.0000000000003103>
- Sobko, I. M., Koliesov, O. V., & Ulaeva, L. O. (2019). Method for the development of physical qualities of tennis players 12-13 years old using react balls and stretching. *Health, Sport, Rehabilitation*. <https://doi.org/10.34142/hsr.2019.05.02.10>

- Sobrin, L., Stone, J. H., Huang, A. J., Niles, J. L., & Nazarian, R. M. (2020). Case 14-2020: A 37-Year-Old Man with Joint Pain and Eye Redness. *New England Journal of Medicine*. <https://doi.org/10.1056/nejmcpc1909623>
- Sojourner, E. J., Burgasser, A. J., & Weise, E. D. (2018). Let's Get Physical: Teaching Physics Through Gymnastics. *The Physics Teacher*. <https://doi.org/10.1119/1.5018692>
- Soraya, N. (2017). Perbandingan Senam Aerobik Mix Impact Dengan Senam Skj 2012 dan Motivasi Berprestasi Terhadap Daya Tahan Cardiorespiratory. *Journal Sport Area*. [https://doi.org/10.25299/sportarea.2017.vol2\(2\).878](https://doi.org/10.25299/sportarea.2017.vol2(2).878)
- Stokes, K. A., Jones, B., Bennett, M., Close, G. L., Gill, N., Hull, J. H., ... Cross, M. (2020). Returning to Play after Prolonged Training Restrictions in Professional Collision Sports. *International Journal of Sports Medicine*. <https://doi.org/10.1055/a-1180-3692>
- Suharti, Nurhasan, & Wiriawan, O. (2019). The influence of physical fitness gymnastics 2017 and Indonesian jaya gymnastics toward flexibility and endurance. *Annals of Tropical Medicine and Public Health*. <https://doi.org/10.36295/ASRO.2019.221119>
- Sumarni, W., Wardani, S., Sudarmin, S., & Gupitasari, D. N. (2016). Project based learning (PBL) to improve psychomotoric skills: A classroom action research. *Jurnal Pendidikan IPA Indonesia*. <https://doi.org/10.15294/jpii.v5i2.4402>
- T., D., S., H., B., W., T.G.D., P., H., S., & T., R. (2019). The effects of physical fitness gymnastics (SKJ) 2012 towards body mass index, body fat percentage, and physical fitness in obese children. *International Journal of Pharmaceutical Research*.
- Taborri, J., Salvatori, S., Mariani, G., Rossi, S., & Patane, F. (2020). BEAT: Balance Evaluation Automated Testbed for the standardization of balance assessment in human wearing exoskeleton. *2020 IEEE International Workshop on Metrology for Industry 4.0 and IoT, MetroInd 4.0 and IoT 2020 - Proceedings*. <https://doi.org/10.1109/MetroInd4.0IoT48571.2020.9138245>
- The formation of young athletes' specialization on the example of rhythmic gymnastics group exercises. (2014). *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*. <https://doi.org/10.6084/m9.figshare.1004095>
- Themanson, J. R., Pontifex, M. B., & Hillman, C. H. (2008). Fitness and action monitoring: Evidence for improved cognitive flexibility in young adults. *Neuroscience*. <https://doi.org/10.1016/j.neuroscience.2008.09.014>
- Walters, S. R., Silva, P., & Nikolai, J. (2017). Teaching, learning, and assessment: Insights into students' motivation to learn. *Qualitative Report*.
- Wärtsilä, & Energy Exemplar. (2012). Power System Optimization By Increased Flexibility. *International Congress on Image and Signal Processing (CISP)*.
- Yarchikovskaya, L. V., Koval, T. E., Lukina, S. M., & Ustinova, O. N. (2017). Role of breathing exercises in combined health programs. *Teoriya i Praktika Fizicheskoy Kultury*.
- Zhang, Y., Wang, Z., Lu, M., Wang, Q., & Wang, H. (2020). Effects of mind-body exercises for osteoporosis in older adults: Protocol for systematic review and Bayesian network meta-analysis of randomized controlled trials. *Medicine*. <https://doi.org/10.1097/MD.00000000000019426>