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METHODOLOGICAL JOURNAL<http://mentaljournal-jspu.uz/index.php/mesmj/index>PEDAGOGICAL EFFECTIVENESS OF DEVELOPING COORDINATION ABILITIES
IN FEMALE STUDENTS THROUGH INNOVATIVE APPROACHES**Shakhnoza Urazoliyeva***Samarkand State Institute of Pedagogy, Basic Doctoral Candidate**Theory and Methodology of Physical Education, Sports Training, and Adaptive Physical Education
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ABOUT ARTICLE

Key words: coordination abilities, innovative model, female students, balance, stabilometry, pedagogical experiment, fitness aerobics, ST-150, TENZA, statistical reliability.

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Abstract: This article presents the findings of an experimental study aimed at developing the coordination abilities of female students majoring in physical education and sport through innovative pedagogical approaches. A pedagogical experiment was conducted at three higher education institutions — Gulistan State University, Navoi State University, and Samarkand State Institute of Pedagogy — with the participation of the experimental and control groups. Balance, spatial orientation, movement coordination, and reaction-speed indicators were assessed using the ST-150 stabilometric platform, the TENZA balance device, the TANITA body-composition analyzer, and a battery of psychomotor tests. The results demonstrated that the innovative model applied in the experimental group — an approach integrating motivational, pedagogical, and digital-technological components — proved considerably more effective than the traditional training system. Statistical analysis (Student's t-test) confirmed reliable differences in favor of the experimental group across all key indicators ($p < 0.05 - 0.001$).

Introduction. Ensuring the physical well-being of the younger generation, and in particular improving the motor activity of female students in higher education institutions, has

been identified as one of the priority directions of state policy. The regulatory and legal documents of the President of the Republic of Uzbekistan aimed at promoting physical education and sport call for elevating students' physical readiness within the higher education system to a qualitatively new level. From this perspective, coordination abilities — that is, the capacity to control movements precisely, maintain balance, orient oneself in space, and adapt quickly — represent one of the key factors determining the overall physical and professional-practical readiness of female students.

A review of the scientific literature shows that, although the development of coordination abilities has long been studied by various international and domestic authors, the question of applying digital monitoring tools together with modern fitness technologies in an integrated manner within higher education — particularly among female student cohorts — remains insufficiently developed. This gap underlies the relevance of the present study: traditional training programs often rely on a limited set of repetitive exercises and do not fully take into account students' individual characteristics or the possibilities offered by contemporary diagnostic tools.

Aim and objectives of the study. The aim of the study was to develop the coordination abilities of female students majoring in physical education and sport through an innovative pedagogical model and to substantiate its effectiveness experimentally. To achieve this aim, the following objectives were set: to analyze the theoretical and methodological foundations of developing coordination abilities; to design a model integrating motivational, pedagogical, and digital-innovative components; to test a methodology based on fitness-aerobics elements; to conduct a comparative analysis of the experimental and control groups' indicators using modern diagnostic equipment (ST-150, TENZA, TANITA, "Psychotest"); and to determine the statistical reliability of the results obtained.

Research methods and organization. The study was carried out at Gulistan State University, Navoi State University, and Samarkand State Institute of Pedagogy, involving a total of 150 female students (experimental group — 75, control group — 75). The initial level of preparedness of the two groups did not differ statistically ($p > 0.05$), which ensured the objectivity of the experiment. In the experimental group, training sessions were organized according to the developed innovative model, using an agility ladder, a Bosu platform, TRX straps, a fitball, a balance disc, and elements of fitness aerobics, while the control group followed the traditional training program.

The following methods and instruments were used for diagnostics: pedagogical observation and testing (Flamingo Balance Test, Romberg test, Star Excursion Balance Test,

4×10 m shuttle run); the ST-150 stabilometric platform (static and dynamic balance, center-of-mass deviation, coordination accuracy); the TENZA balance device; the TANITA body-composition analyzer; the "Psychotest" apparatus (simple and complex reaction time, sensorimotor coordination); a questionnaire survey and expert assessment; and mathematical-statistical methods (arithmetic mean, standard error, Student's t-test).

Results and discussion. The structural basis of the innovative model developed in the course of the experiment consisted of target-oriented, theoretical-methodological, content-related, organizational-activity, diagnostic, and outcome-related components. The model was implemented through a block-based program comprising motivational-activating, coordination-developing, reflective-analytical, and monitoring-assessment blocks. The training content included modern fitness equipment such as an agility ladder, a Bosu platform, TRX straps, a fitball, a balance disc, an elastic band, and a medicine ball, as well as fitness-aerobics elements such as Basic Step, V-Step, and Grapevine. The gradual increase in exercise complexity — moving through diagnostic-preparatory, adaptive-developmental, integrative, and monitoring-assessment stages — helped distribute the training load optimally while accounting for students' individual capabilities.

Table 1. Balance and coordination indicators according to the ST-150 stabilometric platform

Indicator	CG baseline	CG final	EG baseline	EG final	p
Static balance (%)	65.4±1.8	71.2±1.7	65.8±1.7	88.6±1.4	<0.001
Dynamic balance (%)	62.8±1.6	69.1±1.5	63.1±1.5	86.7±1.3	<0.001
Balance stability (%)	66.2±1.5	72.4±1.4	66.5±1.4	89.8±1.2	<0.001
Center-of-mass deviation (mm)	19.4±1.2	17.8±1.1	19.2±1.1	12.8±0.9	<0.01
Coordination accuracy (%)	61.5±1.7	68.3±1.6	61.9±1.6	85.4±1.4	<0.001

According to Table 1, static balance in the experimental group improved by 34.7%, dynamic balance by 37.4%, balance stability by 35.0%, and coordination accuracy by 37.9%, while center-of-mass deviation decreased from 19.2 mm to 12.8 mm. In the control group, the improvement ranged only from 8% to 11%. This gap indicates that the complex of innovative exercises had a significant effect on the quality of balance control.

Table 2. Growth dynamics of balance indicators according to the TENZA device (%)

Indicator	Control group	Experimental group
Overall balance index	9.7	35.6
Static balance	9.7	34.7
Dynamic balance	10.3	38.4
Balance on right leg	14.1	45.5
Balance on left leg	15.8	43.7
Center-of-mass stability	9.1	35.0
Balance reaction	9.2	39.9

The data obtained with the TENZA device confirmed the same tendency: the rate of improvement in the experimental group exceeded that of the control group by three to four times across all indicators. The results for single-leg balance time (right leg — 45.5%, left leg — 43.7%) and balance reaction (39.9%) in particular demonstrate the positive influence of innovative tools such as the Bosu platform and TRX straps on movement control quality.

Table 3. Reaction speed and sensorimotor indicators according to the "Psychotest" apparatus

Indicator	CG baseline	CG final	EG baseline	EG final	p
Simple reaction time (ms)	286.4±8.5	274.8±7.9	285.7±8.2	238.6±6.8	<0.001
Complex reaction time (ms)	412.5±10.2	395.4±9.6	411.8±10.4	342.7±8.5	<0.001
Movement accuracy (%)	72.4±1.8	76.3±1.7	72.8±1.9	89.6±1.5	<0.001
Sensorimotor coordination (%)	69.8±1.7	74.1±1.6	70.1±1.8	87.4±1.4	<0.001

Psychomotor testing showed that in the experimental group simple reaction time decreased from 285.7 ms to 238.6 ms, and complex reaction time from 411.8 ms to 342.7 ms. Movement accuracy increased by 23.1% and sensorimotor coordination by 24.7%. In the control group these indicators changed only within a range of 4–8%, confirming the advantage of the innovative training program in developing rapid reaction and neuromuscular coordination.

Table 4. Summary results of the experiment across three higher education institutions (experimental group, baseline→final)

Institution	Flamingo (error count)	Romberg (s)	SEBT (%)	4×10 m (s)	p
Gulistan SU	12.8→6.9	35.2→52.1	75.9→91.6	12.46→11.32	<0.001/<0.01
Navoi SU	12.5→6.6	34.7→51.8	76.4→92.2	12.39→11.28	<0.001/<0.01

Institution	Flamingo (error count)	Romberg (s)	SEBT (%)	4×10 m (s)	p
SamSIP	12.7→6.7	35.0→52.4	76.1→92.0	12.43→11.30	<0.001/<0.01

The pedagogical experiment conducted at the three institutions revealed a closely similar dynamic across all sites: the number of errors on the Flamingo Balance Test decreased by nearly half at each institution, Romberg test results improved by 48–50%, and Star Excursion Balance Test (SEBT) scores improved by roughly 20%. This consistency indicates that the developed methodology is equally effective under different institutional conditions and supports its potential for broad, universal application.

The overall analysis shows that the digital monitoring tools incorporated into the innovative model (mobile applications, video analysis, QR-coded tasks), combined with fitness-aerobics elements and a differentiated approach, significantly increased not only the female students' coordination abilities but also their motivation for training: according to the survey results, the proportion of students expressing full satisfaction with the sessions rose from 38% to 92%. The statistical reliability of all results obtained was confirmed using Student's t-test ($p < 0.05$ – 0.001), proving that the observed changes were not incidental but resulted directly from the applied methodology.

Conclusion

The experimental study led to the following conclusions:

1. A model integrating motivational, pedagogical, and digital-innovative components developed the female students' balance, spatial orientation, and reaction-speed indicators to a significantly greater degree than the traditional methodology.
2. Fitness-aerobics elements (Basic Step, V-Step, Grapevine) combined with modern sports equipment (Bosu platform, TRX straps, agility ladder) serve to comprehensively develop all structural components of coordination abilities.
3. The use of modern diagnostic devices such as ST-150, TENZA, TANITA, and "Psychotest" allows for objective and precise assessment of coordination readiness and supports the individualization of the training process.
4. The consistency of the results obtained across three different higher education institutions confirms the stable and universal effectiveness of the developed methodology.
5. The findings of the study support the wide-scale introduction of the innovative methodology into undergraduate curricula in physical education and sport, sports clubs, and professional development courses.

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