EFFECTIVENESS OF A GYMNASTICS-BASED METHODOLOGY IN DEVELOPING PROFESSIONAL COMPETENCE OF PHYSICAL EDUCATION STUDENTS: EXPERIMENTAL EVIDENCE

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Abstract. The study tested whether a gymnastics-based methodology improves the professional competence of future physical education teachers more than traditional instruction. A 16-week formative pedagogical experiment was carried out with second-year students of the 60112200 – Physical Culture programme at Asia International University (n = 40; experimental group n = 20, control group n = 20). Professional competence was assessed on a 100-point scale across four components – theoretical knowledge, practical skill, communicativeness and reflectivity – using a triangulated system of a Likert-type questionnaire, a diagnostic test and structured pedagogical observation. The overall competence score of the experimental group rose from 46.1 to 55.2 points (+9.1), against 45.7 to 49.1 points (+3.4) in the control group; the between-group difference was significant (Student's $t = 4.91$; $p < 0.001$). The largest gain was observed in practical skill (+3.7 points), and a moderate positive correlation was found between practical skill and reflectivity ($r = 0.605$). The results indicate that gymnastics, when organised as an integrated theoretical–practical–communicative–reflective system, functions not only as a means of physical preparation but as an effective mechanism of professional teacher formation.

1. Introduction

The quality of teacher education is increasingly judged by graduates' professional competence rather than by the volume of knowledge they have accumulated. In physical education this shift is especially demanding: a future teacher

must not only know the theory of the subject, but also demonstrate movements correctly, organise and manage a group, guarantee safety, give feedback and critically analyse his or her own teaching.

In Uzbekistan, this demand is set out in national policy. The Concept for the Development of the Higher Education System until 2030, approved by Presidential Decree No. PF-5847 of 8 October 2019, provides for the gradual transition of universities to a credit-module system and for practice-oriented training. Presidential Resolution No. PQ-4877 of 3 November 2020 is devoted specifically to improving the system of training personnel in physical culture and sport and raising scientific potential in the field. The "Uzbekistan – 2030" Strategy, approved by Presidential Decree No. PF-158 of 11 September 2023, names an education system that meets international standards among its main goals. Together these documents make the competency-based preparation of physical education teachers a state priority.

Gymnastics occupies a special place in this preparation. It is a compulsory discipline of the physical culture curriculum and one of the richest sources of motor, methodological and organisational experience: it requires precise technique, step-by-step teaching progressions, spotting and safety procedures, and constant verbal explanation. Nevertheless, in traditional university practice gymnastics classes are often treated mainly as a means of improving students' own physical fitness and sports technique. Their potential for developing the methodological, communicative and reflective components of professional competence remains largely unused.

This contradiction – between the high pedagogical potential of gymnastics and its narrowly physical use in teacher education – defines the research problem.

Aim. To test experimentally the effectiveness of a gymnastics-based methodology for developing the professional competence of future physical education teachers.

Hypothesis. If gymnastics classes are organised as a methodological system that integrates theoretical, practical, communicative and reflective modules, students' professional competence will grow significantly more, in all its components, than under traditional instruction.

2. Literature review

The concept of competence used in this study rests on the competency-based paradigm of education. A. V. Khutorskoy treats key competences as a structural unit of person-centred education, integrating knowledge, skills and experience of activity [7]. For physical education, L. P. Matveev describes the professional preparation of the teacher as a unity of motor, methodological and organisational components [8]. L. S. Shulman's idea of pedagogical content knowledge – knowing how to transform subject content into teachable forms – explains why motor mastery alone does not make a competent teacher [11]. D. Schön's concept of the reflective practitioner adds reflection-in-action and reflection-on-action as a core professional capacity [10]. The activity approach of A. N. Leontiev holds that knowledge is appropriated through activity, not through listening or memorisation [6].

International evidence confirms the developmental potential of gymnastics. J. R. Rudd and colleagues compared a 16-week gymnastics curriculum with standard

physical education in 333 primary-school children and found that gymnastics developed stability and object-control skills without hindering locomotor skills or general coordination [9]. At the level of teacher education, M. A. Ávalos-Ramos and colleagues studied 107 Portuguese students of physical activity and sports sciences and found only medium perceived levels of gymnastics teaching competence; students felt least competent in adapting curricular content, and the authors call for experiential, reflective modules that simulate real teaching situations [1]. A study of 87 practising physical education teachers in Ukraine found insufficient command of gymnastic terminology and linked it directly to the quality of professional activity [5].

In Uzbekistan, the developmental possibilities of gymnastics and the formation of teachers' professional competence have been described by national authors [3; 4]. However, in the available studies the effect of gymnastics on the separate components of professional competence has rarely been measured quantitatively, with a control group and inferential statistics. This gap determines the novelty of the present work, which reports the experimental stage of the author's research [12] and is grounded in the author's monograph [13].

3. Materials and methods

Design and participants. A formative pedagogical experiment with a pre-test–post-test control-group design was conducted in the 2024/2025 academic year at Asia International University (Bukhara). Forty second-year students of the 60112200 – Physical Culture bachelor programme took part. They were divided into two groups equalised by initial competence level: the experimental group (EG, n = 20) studied under the gymnastics-based methodology, and the control group (CG, n = 20) followed the standard curriculum.

Procedure. The experiment lasted 16 weeks in three stages.

Stage	Duration	Content
1. Diagnostic	1 week	Questionnaire, diagnostic test and observation to establish the baseline; equalisation of groups
2. Formative	14 weeks	Modular gymnastics-based classes, twice a week, 80 minutes each
3. Control	1 week	Repeated assessment; statistical and pedagogical analysis

Intervention. In the EG, classes were built on a four-module system:

1. Theoretical module – exercise technique, pedagogical requirements, lesson planning.
2. Practical module – correct performance and demonstration of exercises, organising independent practice, spotting and safety.
3. Communicative module – working with a group, managing the lesson, giving feedback.
4. Reflective module – evaluating one's own activity, identifying errors, self-analysis.

Each lesson had an introductory part (10–15 min), a main part (50–55 min) and a closing part (10–15 min); a structured reflective analysis was compulsory in every closing part. Active methods were used: modular teaching, role play, the "student as teacher" task, peer analysis in pairs, training sessions and problem situations. The gymnasium was equipped with rings, mats, beams and gymnastic sticks, and feedback was given after every lesson.

Measures. Professional competence was assessed on a 100-point scale, 25 points per component.

Component	Content assessed	Method	Max. points
Theoretical knowledge	Gymnastics fundamentals, exercise technique, teaching methodology	Test, oral questioning	25
Practical skill	Demonstrating and explaining exercises, organising the lesson, safety	Practical task, observation	25
Communicativeness	Group management, verbal explanation, motivation	Timed observation, rating sheet	25
Reflectivity	Analysis of activity and errors, drawing conclusions	Written task, interview	25
Total	Overall level of professional competence	Unified assessment sheet	100

Assessment followed the principle of triangulation: a 20-item four-point Likert-type questionnaire, a four-module diagnostic test, and a five-indicator observation sheet completed in weeks 1, 8 and 16.

Statistical analysis. Means (M), variances (σ^2) and standard deviations (σ) were calculated. Between-group differences were tested with Student's t-test and one-way analysis of variance (ANOVA); effect sizes were expressed as eta squared (η^2) and interpreted by conventional thresholds [2]. Relationships between components were assessed with Pearson's correlation coefficient (r). The significance level was set at $p < 0.05$.

4. Results

Overall competence. At baseline the two groups did not differ meaningfully (EG 46.1, CG 45.7 points), which confirms that they were equivalent. After 16 weeks the EG gained 9.1 points and the CG 3.4 points, so the gain in the EG was 2.7 times larger. The between-group difference was significant ($t = 4.91$; $p < 0.001$).

Group	Pre-test M	Post-test M	Gain	σ^2
Experimental (n = 20)	46.1	55.2	+9.1	8.76

Group	Pre-test M	Post-test M	Gain	σ^2
Control (n = 20)	45.7	49.1	+3.4	4.13

The larger variance in the EG ($\sigma^2 = 8.76$ vs 4.13) shows that individual rates of growth differed more under the new methodology: students with different starting levels benefited to a different extent. This points to the need for a differentiated approach within the methodology.

Components of competence. The EG's post-test scores exceeded those of the CG in every component, by 1.5 to 2.6 points.

Component (max. 25)	EG pre	EG post	EG gain	CG post
Theoretical knowledge	11.5	14.2	+2.7	12.4
Practical skill	10.8	14.5	+3.7	11.9
Communicativeness	11.2	13.6	+2.4	12.1
Reflectivity	12.6	14.9	+2.3	13.3

The largest gain was in practical skill (+3.7), which follows from repeated hands-on work with apparatus: demonstrating exercises, explaining technique and ensuring safety. The smaller gain in reflectivity (+2.3) is explained by its highest baseline (12.6 points), i.e. a ceiling effect.

Effect sizes. One-way ANOVA by component showed a large effect of the methodology on every component ($\eta^2 \geq 0.14$).

Component	F	p	η^2	Effect
Reflective	10.02	0.0023	0.29	Large
Practical (motor)	8.57	0.0041	0.25	Large
Methodical	7.21	0.0068	0.21	Large
Communicative	5.44	0.0201	0.17	Large

Correlation. For all 40 students, practical skill and reflectivity correlated moderately and positively ($r = 0.605$). Reflectivity scores were more dispersed ($\sigma = 1.32$) than practical skill scores ($\sigma = 0.95$).

5. Discussion

The hypothesis was confirmed: when gymnastics classes integrate theoretical, practical, communicative and reflective modules, students' professional competence grows significantly more than under traditional instruction, and the effect is visible in every component.

The result agrees with international findings on the developmental value of gymnastics. Rudd et al. showed that a 16-week gymnastics curriculum improves children's movement competence beyond standard physical education [9]; the present study extends this evidence from pupils' motor outcomes to future teachers' professional outcomes, with an intervention of the same length. It also responds to

the gap reported by Ávalos-Ramos et al., whose students felt least prepared to adapt gymnastics content to real teaching [1]: the "student as teacher" tasks and compulsory reflective analysis in our methodology were designed precisely to rehearse such adaptation.

The strongest effect on the reflective component ($\eta^2 = 0.29$) is the most notable finding. It suggests that gymnastics, with its clear technical criteria and visible errors, is a convenient field for training the teacher's analytical thinking, in line with Schön's view of reflection as a core professional capacity [10]. At the same time, the correlation between practical skill and reflectivity was only moderate ($r = 0.605$). Reflection therefore does not develop automatically through repetition of exercises; it requires its own methodological support, which is why the reflective module must remain a separate, compulsory element.

The higher dispersion of results in the EG and in the reflective component shows that students responded to the methodology unevenly. This supports a differentiated, person-centred extension of the methodology that takes into account students' initial preparation and physical condition.

Limitations. The sample was small ($n = 40$) and drawn from one university, and groups were equalised rather than randomly assigned. The long-term stability of the gains was not tested. Future work should involve several universities, larger samples, randomisation and delayed post-tests.

6. Conclusion

A gymnastics-based methodology built on the integration of systemic, competency-based and activity approaches proved effective for developing the professional competence of future physical education teachers. Over 16 weeks the overall score of the experimental group rose by 9.1 points against 3.4 points in the control group ($t = 4.91$; $p < 0.001$), with large effects in every component and the strongest effect in reflectivity.

On the basis of the results, the following recommendations are made for physical education teacher education: Design gymnastics classes along the chain "aim – method – means – result", integrating theoretical, practical, communicative and reflective modules. Make reflective analysis (discussion, peer analysis, written self-assessment) a compulsory element of the closing part of every lesson. Regularly give students the role of teacher: demonstrating, explaining, spotting and correcting errors in peers. Develop differentiated modules that take account of students' initial preparation and physical condition. Integrate an indicator-based diagnostic of professional competence into the curriculum of the gymnastics course.

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