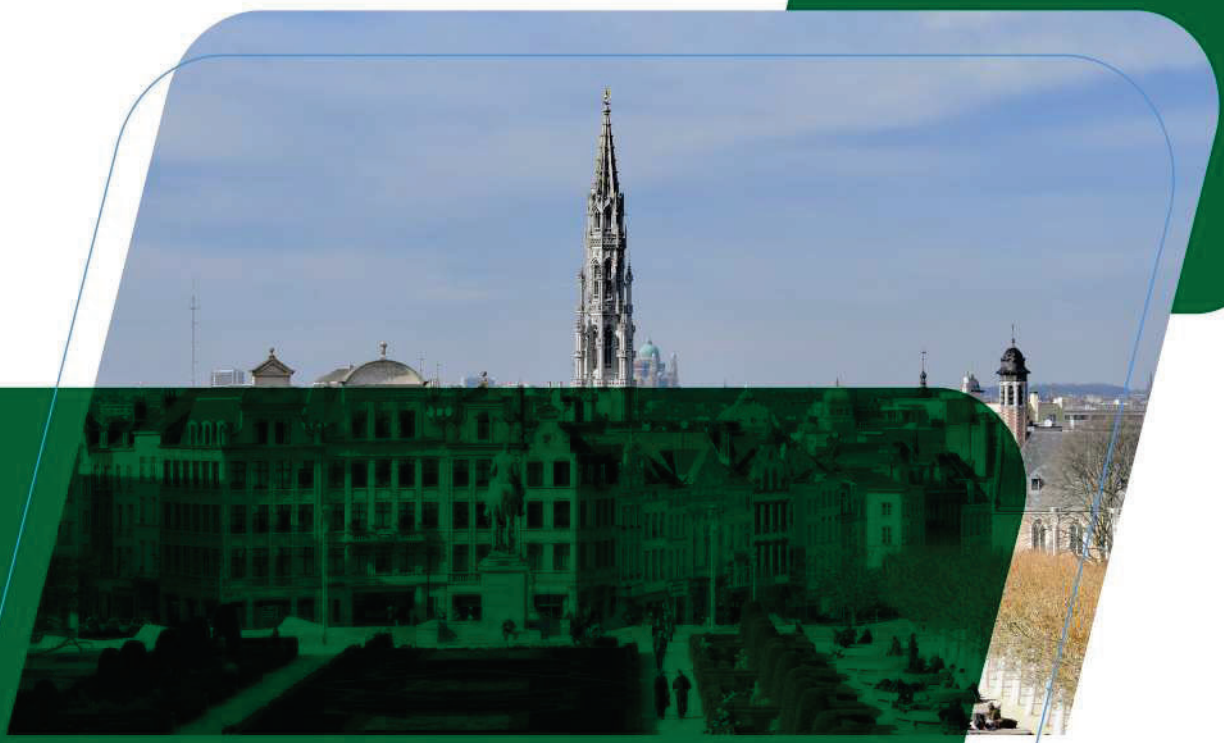
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INNOVATIVE EDUCATIONAL STRATEGIES FOR TEACHING BIOMECHANICS IN PROGRAMS ON WELLNESS AND SPA CULTURE

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Abstract

The aim of this study was to assess the demand for specialised staff in the recreational industry and to create innovative educational tools for the "Biomechanics" modules in the five accredited programs on Wellness & SPA & Thalasso culture at the National Sports Academy "V. Levski". Our scientific interests were focused on developing content for five new educational tools: one for the educational level of Bachelor's degree, two for Master's degree, and two for Doctoral degree in two professional fields: 7.5 Healthcare and 7.6 Sports. The document discusses innovative educational strategies for teaching biomechanics in programs on wellness and spa culture, focusing on the importance of specialized staff in the recreational industry and the development of new educational tools. The results of the study clearly proved the significance of biomechanics knowledge in shaping the professional competencies of specialised staff for Niche tourism. We revealed the direct interdependence between biomechanics knowledge and the quality of managing Wellness programs.

Keywords: Biomechanics, innovations, didactic, interactive methods, specialised personnel, Wellness & SPA business

1. Introduction

Six of the top ten most popular wellness destinations globally are in Europe. The European wellness sector emphasizes the critical role of education and training in maintaining its leadership and ensuring the delivery of high-quality services (Dimitrova 2020; 2025;. Nesheva 2020). As highlighted in various studies, the Wellness and Spa tourism sector is a rapidly growing business (Angelcheva 2022; Polimenov 2023). Wellness tourism encompasses travel experiences designed to promote health and well-being, focusing on enhancing physical, mental, and spiritual health (Polimenov 2019). This often involves activities such as spa treatments, relaxing sessions, meditation, motivation and nutritious dining (Dimitrova 2017a; Popova-Dobreva 2020; Nesheva 2023a; Tomova 2024). Conversely, recreational programs centre on health-enhancing activities that foster physical and mental relaxation, including hiking, yoga, aerobics, and water-based exercises like aqua aerobics (Chipeva 2019; Dimitrova 2019a; Tomova 2025; Nesheva 2023). The Niche tourism industry's expansion and competitiveness are hindered by the absence of clear definitions and standards, along with a shortage of trained professionals (Dimitrova 2019; Polimenov 2022; 2025; Nesheva et al. 2025). To overcome these challenges and unlock the potential of this sector, Bulgaria must prioritise investments in educational programs aimed at developing skilled wellness and recreational professionals. Establishing clear guidelines and standards for the wellness industry is a cost-effective approach to fostering growth and quality improvement. Enhancing the content of "Biomechanics" modules can significantly elevate the quality of programs focused on recreational physical activities and promoting a wellness-oriented lifestyle (Dimitrova 2017; Tomova 2024a; Polimenov 2025a). As the demand for specialised wellness packages continues to rise, the need for qualified personnel surpasses the current supply, highlighting the importance of educational, training, and certification initiatives for industry professionals. Our work represents an initial effort to integrate Biomechanics into theoretical and experimental studies on the mechanical behavior of living systems, with the goal of promoting a healthy lifestyle. In Wellness and Spa culture educational programs, the human body's structures and functions are examined across multiple levels. Incorporating the analysis of dynamic models, 3D computer modeling, and simulation of human movements is poised to usher in a transformative phase for the recreational industry. The insights gained from this research will enhance specialised understanding of biomechanical processes in living systems under normal conditions and support their application in recreation and disease prevention through physical activity. Anticipated outcomes from this research include improved service quality in the wellness sector and the development of innovative exercise

programs aimed at health promotion and disease prevention. The benefits of recreational physical activity on the health of participants lead to increased demand, respectively, revenues, and the need for competent personnel in Niche tourism.

2. Methods

Purpose: *The aim of this study was to assess the demand for specialised staff in the recreational industry and to create innovative educational tools for the "Biomechanics" modules in the accredited five programs in Wellness and SPA & Thalasso culture at the National Sports Academy "V. Levski".*

Focus: *Our scientific interests were focused on developing content for five new educational tools: one for the educational level of Bachelor's degree, two for Master's degree, and two for Doctoral degree.*

Subject: *The study was conducted among 110 students in two professional fields: 7.5 Healthcare and 7.6 Sports. The subjects were predominantly Bulgarians, with an average age of 24 years and a balanced representation of both genders. They were distributed into three different groups (18 - 22 years; 23 - 27 years; 28 - 32 years) based on their educational level of preparation according to the specific "Biomechanics" module.*

Interactive methodological approaches in teaching: *Interactive methods of learning, teaching, and assessment was applied.*

Interactive presentations with information technology: *This method involves using technologies such as interactive whiteboards, mobile applications, and online platforms during lectures to increase student engagement. Technologies can be used to conduct real-time surveys, quizzes, and interactive discussions, which encourage participation and improve understanding of the material.*

Flipped Classroom: *With this approach, students study new material at home through video lectures or readings, and in-class sessions are used for active participation through exercises, discussions, and application of knowledge under the guidance of the instructor. This promotes deeper understanding and allows teachers to provide personalized support.*

Problem-based learning: *This method focuses on learning through solving real and complex problems that are not limited to one discipline or area of knowledge. Students work in groups to explore the problems, develop solutions, and present their findings, thereby developing skills in critical thinking, collaboration, and self-directed learning.*

Interactive assessment technologies: *The use of online platforms and assessment tools provides opportunities for continuous progress tracking and instant feedback to students. This includes online tests and quizzes that allow students to understand their strengths and weaknesses and work on improvement in real-time.*

3. Results

It is widely known and scientifically proven that injuries, cardiovascular disorders, even cancerous tumours occur due to sedentary lifestyle or abuse of harmful fatty foods, alcohol, etc. Biomechanical knowledge and research will support studies in the field of physical activity in the Recreational industry, which is different in nature from elite sports but due to its massiveness carries high social impact. With the financial support of the Centre for Excellence "Heritage BG," new programs in Wellness & Spa & Thalasso culture were developed and accredited (Harizanova 2019). Significant results were achieved in the development of educational tools: programs, textbooks, modules, monographs, methodological guides, etc. We present the data from a statistics analysis for the Market size of the wellness industry worldwide conducted in 2023 and published by Christina Gough in 2024 (see fig. 1).

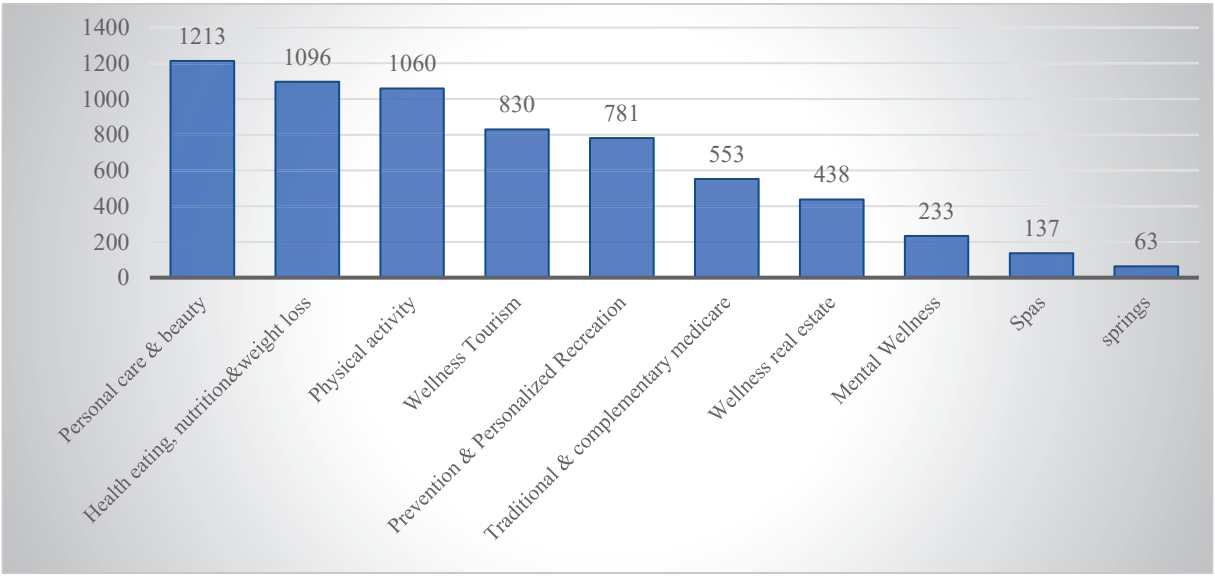


Figure 1. The market size of the wellness industry worldwide by segment, in billion U.S. dollars (source: https://www.statista.com/research)

Here we share a table with some statistics for educational or training programs in Spa & Wellness Culture across Europe and the Balkans. The data for the educational or training programs on the Balkan region are published with the permission of the Balkan Cluster for Health, Wellness and Spa culture, from their private study in 2023 (see tab. 1).

Table 1. *Types of educational or training programs for Spa & Wellness Culture in the Balkans*

Classification of the Educational or Training Programs in the Wellness and Spa Sector				
Country	*Total number of Educational programs*	*University program*	*Private companies*	
			Bachelor/Master/PhD Accredited programs	*Vocational education/Short courses/Seminars/Trainings/ Certifications*
Bulgaria	*7*	*3*	*6 + 1 PhD „Philosophy Doctor"*	*1*
North Macedonia	*2*	*-*	*-*	*2*
Switzerland	*2*	*2*	*1*	*1*
Turkey	*1*	*-*	*-*	*1*
Total	*12*	*5*	*8*	*5*
**** Note: The data for the programs are collected by private sources and are the intellectual property of the Balkan Cluster for Health, Wellness, and Spa Tourism.*				

We systematized the data by type of educational or training programs for specialised staff in Europe. We selected the indicators: educational level, professional field, diploma, number of programs, annual graduates and duration. We included universities, colleges, and private training providers. There is a noticeable lower educational level of the programs offered in Europe compared to those in the Balkans. Evidence of this is the duration of the training or educational programs. In the Balkans, over 50% of the offered programs are accredited according to the requirements of the European Accreditation Agency at the "bachelor," "master," and "doctoral" levels (see tab. 2).

Table 2. Types of educational or training programs for Spa & Wellness Culture in Europe

Region	Number of Programs	Annual Graduates	Specializations Offered	Average Duration	Key Focus Areas	Institutions Involved
Western Europe	120	5,000	Spa Management, Wellness Tourism, Fitness Coaching	1–2 years	Business Management, Sustainability, Holistic Therapies	Universities, Private Institutes
Eastern Europe	90	3,800	Massage Therapy, Wellness Practices, Nutrition	1–2 years	Preventive Health, Rehabilitation, Spa Design	Technical Schools, Colleges
Balkans	50	2,500	Biomechanics, Hydrotherapy, Aromatherapy	6 months–2 years	Cultural Wellness Practices, Nature-Based Healing	National Training Centers
Scandinavia	30	1,200	Nordic Wellness, Fitness & Lifestyle Coaching	1 year	Outdoor Activities, Thermal Baths, Minimalism	Wellness Academies, Universities
Southern Europe	75	4,200	Mediterranean Diet & Wellness, Spa Architecture	1–3 years	Culinary Wellness, Spa Technologies	Universities, Specialized Schools
Central Europe	100	4,500	Physical Therapy, Spa Operations Management	1–2 years	Evidence-Based Practices, Health Tourism	Universities, Private Institutions

NOTES:

1. *Number of Programs: Includes vocational training, diploma, and degree programs.*
2. *Specializations Offered: Key focus areas taught within the programs.*
3. *Institutions Involved: Includes universities, colleges, and private training providers.*

These data demonstrate the high quality and sustainability of the educational programs in Wellness and Spa culture in the Balkans. As shown in table 1, Bulgaria stands out as a leader, with 8 programs accredited under the standards of the three European educational levels for higher education (conform with EQF).

Innovative developments allowed for the specification of module content according to the needs of the educational level. In this material, we analyse the content of "Biomechanics." The acquired knowledge, intellectual, and practical skills shape professional competencies according to the needs of the business. For the first time, we developed specific requirements according to the European Qualifications Framework from EQF "Bachelor" to EQF "Doctor." This guarantees the provision of up-to-date knowledge and skills through a strict methodology for coping with the latest European and Bulgarian policies regarding social Wellbeing, education, and tourism development. Globally, there is a lack of educational programs for training specialized personnel in the Recreational industry. In the accredited new programs for specialized personnel in Bulgarian Niche tourism, five "Biomechanics" modules are included. Their content has been developed by our scientific expert Assoc. Prof. Eng. Ognian Tishinov, Ph.D. (see tab. 3).

Here we share (as author of all accredited programs in Wellness & Spa Culture at NSA "V. Levski") the specificities and arguments for the „Biomechanics Modules" thematic content by the tutor expert opinion: Biomechanics emerged as an interdisciplinary science between biology and mechanics in the 1930s. Its primary focus is on the active movements of living organisms (such as the flight of birds, insects, or the swimming of dolphins), with particular interest in human movement in both aerial and aquatic environments.

Table 3. Organizing the "Biomechanics" modules by educational level and professional field

Professional Field	Educational level	Program	Cod	Title	ECTS
PF.7.6. Sport	„Bachelor“ degree	Wellness and Spa Consultant	SPA. I.4	Biomechanics and Biophysics (Required Module)	2
PF.7.6. Sport	„Masters“ degree	Spa culture, east and aqua practices	SPA. II.3	Bioenergetics in Aquatic Environment Movement (Specialized Module)	1
PF.7.5. Health Care	„Masters“ degree	Spa culture, hydro, lyto and Thalasso practices	SPA2 I.6	Biomechanics and Analysis of Sports Technique (Required Module)	2
PF.7.5. Health Care	Doctoral degree	Wellness – Health promotion	Ph.D. W.II.3.	Motor Recreation Management. Biomechanical Foundations of Compensatory Mechanisms in Motor Actions. (Specialized Module)	2
PF.7.6. Sport	Doctoral degree	High-performance sports	Ph.D. S.II.3.	Sports Technique Management. Biomechanical Foundations of Compensatory Mechanisms in Motor Actions. (Specialized Module)	3

Due to the complexity of living organisms, analysing their movements requires an interdisciplinary approach. Biomechanics studies the movements of living organisms as well as the changes in those movements caused by various forces. The diverse activities in human life (work, daily activities, sport, etc.) create different branches within biomechanics: occupational biomechanics, biomechanics of theatre, space biomechanics, etc. Of particular interest to us is sports biomechanics, which addresses fundamental challenges faced by sports specialists. To increase their knowledge of the structure, properties, and functions of the human body. To choose the most appropriate sports technique for a given athlete according to the biomechanical characteristics of their motor apparatus. To develop the most efficient technique for a particular sport. We present the knowledge rate segmentation by eXplainable AI (see fig. 2):



Figure 2. Segmentation of knowledge levels using eXplainable AI (excluding Biomechanics theory information for knowledge variation) within the three degree programs.

To assess and control the level of risk to reduce sports-related injuries. Biomechanics addresses several other key tasks (see fig.3):

- *to create and improve the biomechanical basis of special exercises that enhance the individual physical and motor qualities of athletes.*
- *to enhance existing and develop new biomechanical methods for ongoing monitoring of sports training;*
- *to improve existing and develop new methodologies for the study, analysis, and management of movements.*

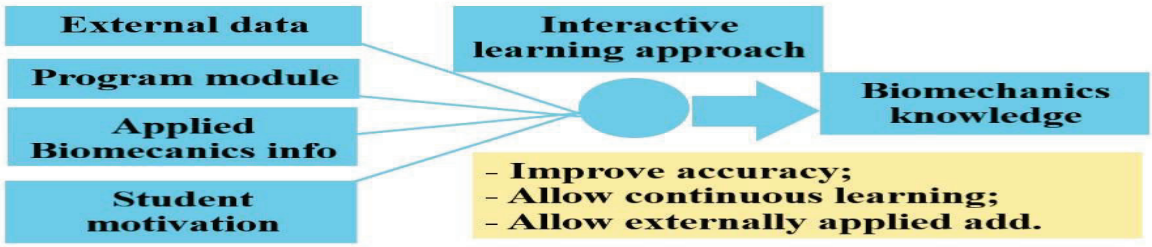


Figure 3. Knowledge interrelationship during the interactive learning process for acquiring Biomechanics

In the module designated for training in the Bachelor's degree program, the basic concepts of mechanics related to kinematic and dynamometric characteristics, as well as the principles of biomechanical efficiency, are presented. These include criteria for the impulse of force in relation to the effectiveness of motor activity, for the long and straight path of acceleration, for the coordination of individual impulses, for resistance and sensitivity to precise action, and for the conservation of the quantity of motion.

Training in the Master's degree program module focuses on the practical application of methods for biomechanical analysis. Two credits in the discipline are included. Through practical exercises and seminars, students acquire knowledge of sports training and individualisation in maintaining athletic performance (see fig.4).

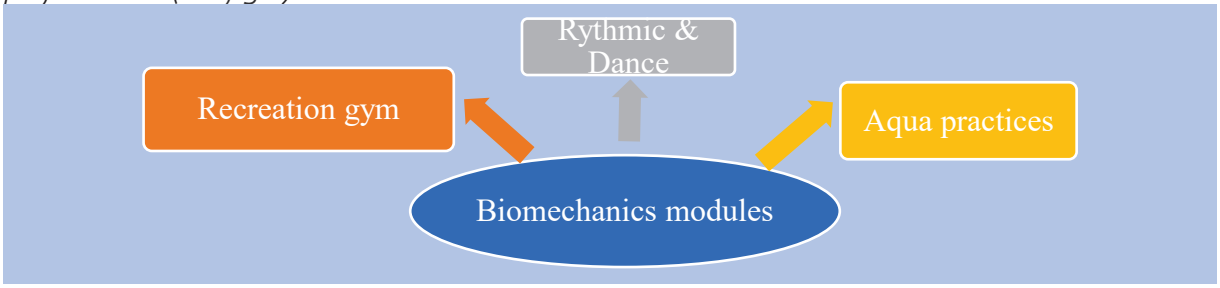


Figure 4. Internal relationships of the knowledge between the Biomechanics and the specialised modules.

Training in the Biomechanics module in the Doctoral (PhD) program includes the development of scientific topics, lately combined with training in ERASMUS, following good European practices in education in EU countries. The preparation of a dissertation combines theoretical development, mathematical justification of conclusions presented to a competent jury. A good opportunity is for the materials for defence to be based on publications - at least two in indexed journals. Of interest is the concluding phase for students with high qualifications in the next opportunity for young researchers - post-doctoral training, which is widely represented in Europe, as well as in the USA, Japan, and Switzerland. Below are the codes and titles of the modules by educational level. The newly created educational programs cater to diverse job roles and skills, ranging from operational specialists to managerial positions. Bulgaria has classified three new professions with identification numbers in Class level 1 of the "Classification of Professions and Positions": Spa Centre Manager (1431-6027), Wellness Centre Manager (1431-6028), and Thalassotherapy Centre Manager (1431-6029). These professions respond to changes and new requirements in the Tourism Law. This policy has a high social impact and supports encouraging citizens to adopt a healthy lifestyle. The ultimate result contributes to improving the nation's Wellbeing index. Developing innovative teaching methods and extensive research for the Wellness and Spa sector are part of this effort. Developing specialised innovations inside the content of Biomechanics modules provides personnel with knowledge that enhances their professional competencies. Biomechanics modules are integrated into wellness programs through a structured educational approach that spans various academic levels. Here's how they are incorporated:

1. *Bachelor's Degree Level:*
   - *Basic Concepts: Introduction to fundamental biomechanics concepts such as kinematic and dynamometric characteristics, principles of biomechanical efficiency, and criteria for effective motor activity.*
   - *Practical Application: Students learn to apply these concepts through practical exercises and interactive learning methods.*
2. *Master's Degree Level:*
   - *Advanced Techniques: Focus on the practical application of biomechanical analysis methods.*

- *Specialized Training: Includes practical exercises and seminars to deepen knowledge in sports training and individualization of athletic performance.*
- *Credits: Typically, two credits are allocated to this discipline, emphasizing hands-on learning and real-world application.*

3. *Doctoral Degree Level:*

- *Research and Development: Involves the development of scientific topics and research projects, often in collaboration with European educational practices through programs like ERASMUS.*
- *Dissertation Work: Students prepare dissertations that combine theoretical development with practical research, often requiring publications in indexed journals.*
- *Post-Doctoral Opportunities: High-qualified students may pursue post-doctoral training, further enhancing their expertise and research capabilities.*

4. *Interactive Learning Methods:*

- *Interactive Presentations: Use of technologies like interactive whiteboards, mobile applications, and online platforms to engage students.*
- *Flipped Classroom: Students study new material at home and engage in active learning during in-class sessions.*
- *Problem-Based Learning: Students solve real and complex problems in groups, fostering critical thinking and collaboration.*
- *Interactive Assessment: Continuous progress tracking and instant feedback through online platforms and assessment tools.*

5. *Specialized Modules:*

- *Recreation Gym, Rhythmic & Dance, Aqua Practices: Specific modules that integrate biomechanics knowledge into various wellness activities, ensuring a comprehensive understanding of human movement and its applications in wellness programs.*

By integrating biomechanics modules at different educational levels and using innovative teaching methods, wellness programs can ensure that professionals are well-equipped with the necessary knowledge and skills to deliver high-quality services.

4. Discussion

The Physical Activity Global market size is constituently growing from $789,5 billion in 2017, to 976,5 billion in 2022. For the next four years the growth projections are to attend 1,352,4 billion in 2027 (see fig.5).



Figure 5. The Physical Activity Global market size 2017 to 2027 (source GWI' 2024)

Due to the limited number of educational programs for training personnel in the Wellness & Spa business, there is a Global war for well-trained staff for Niche tourism. The above figures justify the social significance and necessity of personnel in the sector with high-quality professional competencies. Through its five accredited programs, Bulgaria is not only becoming a Regional but also a European educational leader in the Recreational industry.



Figure 6. *The Wellness Travels Market size historical projected (source GWI' 2024 and Eurobarometer)*

The Wellness Travel Global market size is constituently growing from $93,6 billion in 2017, to 104,5 billion in 2022. For the next four years the growth projections are to attend 156,1 billion in 2027 (see fig. 6). For the quality implementation of Recreational physical activity programs and sustainable service levels for Recreation, the application of knowledge and skills in "Biomechanics" holds a central place in practice. Specialised knowledge for the knee and ankle flexion and extension indicators joints during jumping, squat-jumps, or coordinating movements at high individual speeds in the execution of repetitive cyclic movements has been proven as very important to protect clients from injury. Another important skill is training the client in stable support and balanced stability during the execution of cardio recreational programs for body shaping.

5. Conclusion

The study conducted at the National Sports Academy "Vasil Levski" aimed to assess the demand for specialized staff in the recreational industry and develop innovative educational tools for the "Biomechanics" modules in Wellness & SPA & Thalasso culture programs. Key findings and conclusions include:

1. Significance of Biomechanics Knowledge: The study highlighted the importance of biomechanics knowledge in shaping the professional competencies of specialized staff in the niche tourism sector, particularly in managing wellness programs.

2. Educational Program Development: Five new educational tools were developed for different educational levels (Bachelor's, Master's, and Doctoral degrees) to enhance the quality of biomechanics education.

3. Interactive Learning Methods: Innovative teaching methods such as interactive presentations, flipped classrooms, problem-based learning, and interactive assessment technologies were employed to improve student engagement and understanding.

4. Market Demand and Growth: The wellness and recreational industry is rapidly growing, with a significant demand for qualified personnel. The study emphasized the need for educational, training, and certification initiatives to meet this demand.

5. Health Benefits and Economic Impact: Recreational physical activity programs have proven health benefits, leading to increased demand and revenue in the wellness sector. This underscores the need for competent personnel to deliver high-quality services.

6. Educational Leadership: Bulgaria, through its accredited programs, is becoming a regional and European leader in the recreational industry, contributing to the nation's wellbeing index.

7. Future Prospects: The integration of biomechanics into educational programs is expected to improve service quality in the wellness sector and support the development of innovative exercise programs aimed at health promotion and disease prevention.

8. Overall, the study concluded that enhancing biomechanics education is crucial for the growth and quality improvement of the wellness and recreational industry, addressing the shortage of trained professionals and promoting a healthy lifestyle.

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THE IMPORTANCE OF USING STEM PROJECTS IN CHEMISTRY EDUCATION

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ХИМИЯ ПӘНІН ОҚЫТУДА STEM ЖОБАЛАРЫМЕН ЖҰМЫС ІСТЕУДІҢ МАҢЫЗЫ

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Abstract

This review article explores the significance of implementing STEM projects in chemistry education and analyzes their effectiveness based on contemporary scientific literature. The integration of STEM principles into chemistry lessons enhances the connection between theoretical knowledge and real-life applications by engaging students in experimentation, problem-solving, and project-based tasks. Findings indicate that STEM projects increase students' motivation, deepen their understanding of chemical phenomena, and foster the development of laboratory skills, research competence, engineering thinking, creativity, and collaboration. Additionally, STEM activities contribute to strengthening safety culture and improving scientific literacy. However, several challenges remain, including insufficient material resources, limited teacher preparedness, restricted instructional time, and the lack of clear assessment criteria. Addressing these issues is essential for effective implementation. Overall, STEM projects significantly improve the quality of chemistry education and support the formation of essential 21st-century competencies. Strengthening teacher training, equipping STEM laboratories, and integrating project-based learning systematically are recommended.

Аңдатпа

Бұл шолу мақаласында химия пәнінде STEM жобаларын қолданудың маңызы қарастырылып, қазіргі ғылыми әдебиеттер негізінде олардың тиімділігі талданады. Химия сабақтарына STEM қағидаларын енгізу теориялық білімді өмірмен байланыстырып, оқушыларды тәжірибелік жұмыстар, проблемаларды шешу және жобалық әрекеттер арқылы белсенді оқытуға мүмкіндік береді. Зерттеулер STEM жобалары оқушылардың мотивациясын арттыратынын, химиялық құбылыстарды терең түсінуге көмектесетінін, зертханалық дағдыларды, зерттеушілік қабілетті, инженерлік ойлауды, шығармашылықты және топтық жұмысты дамытуға ықпал ететінін көрсетеді. Сонымен қатар STEM жобалары қауіпсіздік мәдениетін нығайтып, ғылыми сауаттылықтың қалыптасуына әсер етеді. Алайда материалдық-техникалық базаның жеткіліксіздігі, мұғалімдердің дайындық деңгейінің төмендігі, уақыт тапшылығы және бағалау критерийлерінің айқын болмауы сияқты қиындықтар кездеседі. Бұл мәселелерді шешу STEM тәсілін тиімді енгізудің негізгі шарты болып табылады. Жалпы алғанда, STEM жобалары химияны оқытудың сапасын арттырып, XXI ғасыр дағдыларын қалыптастыруда маңызды рөл атқарады. Мұғалімдерге әдістемелік қолдау көрсету, мектептерді STEM зертханаларымен жабдықтау және жобалық оқытуды жүйелі енгізу ұсынылады.

Keywords: *STEM education, chemistry teaching, project-based learning, research skills, laboratory competence, scientific literacy.*

Түйінді сөздер: *STEM білім беру, химияны оқыту, жобалық оқыту, зерттеушілік дағды, зертханалық құзырет, ғылыми сауаттылық.*

Kipicne

Қазіргі әлемде білім беру жүйесі қоғамның ғылыми-техникалық дамуымен тікелей байланысты болып отыр. XXI ғасырдың талабына сай мектеп оқушылары тек пәндік білімді ғана емес, сонымен қатар функционалдық сауаттылық, зерттеушілік мәдениет, сыни және шығармашылық ойлау секілді әмбебап дағдыларды игеруі тиіс. Осындай құзыреттерді қалыптастыруда жаратылыстану пәндерінің, оның ішінде химияның рөлі ерекше, себебі химия табиғат құбылыстарын тәжірибе арқылы түсіндіретін қолданбалы ғылым [1].

Соңғы жылдары әлемдік білім беру кеңістігінде STEM (Science, Technology, Engineering,