Brief Report

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Seven Technology-Based Active Learning Models for Educational System Transformation: A Policy Brief

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Introduction: With the spread of new technologies, significant changes have occurred in teaching and learning, which can be used to overcome the challenges of the traditional education system, such as lecture-based teaching methods, limited opportunities for active learning, lack of attention to problem-solving skills such as creative and critical thinking, and rote assessment methods.

Method: The study adopts a policy analysis and conceptual synthesis approach, reviewing existing literature to propose seven technology-based educational models: gamified learning, problem-based learning, AI-driven classrooms, IoB-based smart schools, team-based learning, lifelong learning, and flipped learning.

Results: Results indicated that these models collectively enhanced student engagement, motivation, personalization, collaboration, critical thinking, and well-being. Gamified learning increased motivation and participation; PBL strengthened problem-solving and experiential learning. Also, AI-driven classrooms enabled adaptive, personalized learning, and IoB-based smart schools supported real-time monitoring of learning behaviors and mental health. Moreover, team-based learning improved collaboration and communication skills, and lifelong learning fostered self-regulated and continuous skill development; flipped learning increased active classroom participation and academic performance. Together, these approaches provide complementary pathways for addressing structural inefficiencies in traditional education systems and improving overall educational quality and equity.

Conclusion: Integrating these seven models offers a coherent framework for transforming traditional education into a technology-enhanced, learner-centered system. However, successful implementation requires phased adoption, infrastructure development, teacher training, and attention to ethical and equity considerations. Gradual integration, starting with low-cost pedagogical models and progressing toward advanced AI and IoB systems, can lead to sustainable and context-sensitive educational reform in developing educational contexts overall.

Keywords: Educational technology, Artificial intelligence, Problem-based learning, Internet-based intervention, Mental health, Gamification

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Introduction

In recent years, the rise of digital technologies has transformed modern teaching method These technologies and approaches can overcome the challenges of the traditional education system. Especially for developing countries like Iran, the traditional education system faces a wide range of structural and operational challenges that have made it difficult to teach and transfer knowledge to learners (1). The traditional structure and content of curricula are not aligned with essential competencies such as critical thinking, problem solving, collaboration, and digital literacy (2, 3). The curriculum content is not personalized, and teaching methods remain lecture-based (4). This reduces student engagement and motivation (5). In addition, the school assessment system remains predominantly exam-oriented and memory-based, with limited use of analytical data to evaluate the students' actual competencies (6). This approach restricts the development of creativity, deep learning, and intrinsic motivation (7).

According to Iran's 2022-2023 Ministry of Education statistical yearbook, approximately 279,000 children had dropped out of school nationwide (8). In higher education, studies have indicated that over 50% of medical students have low motivation (9), and this number has recently been on increase (10). Recent studies have shown notable psychological disorders (e.g., educational burnout, depression, anxiety, stress rates) among medical students in Iran (11). Rising anxiety, reduced attention spans, and declining motivation among students indicate the need for innovative models of monitoring and intervention in students' health and well-being to enhance learning quality (12). Evidence from multiple systematic reviews suggests that innovative approaches are recognized as key drivers of educational quality improvement, and their application can help drive transformative reform in Iran's education system.

Policy Recommendations

In this policy brief, seven innovative technology-based models are proposed to improve the quality of education, as follows (Figure 1).

Gamified Learning: The first model is the use of a "Gamified Learning" approach that plays a major role in improving motivation, engagement, and the depth of learning. Gamification for learning is a method by which game components such as points, levels, badges, individual and group challenges, and leaderboards are used to improve learning (13, 14). Gamification provides significant benefits for educational service providers by enhancing knowledge acquisition and job skills, supporting repeated learning experiences, facilitating adult education, improving the teaching-learning process, providing timely feedback, strengthening educator–learner interaction, promoting participation and engagement, and increasing learners' interest, motivation and overall learning effectiveness (13). It promotes active learning and encourages collaboration, resulting in a more engaging and interactive educational experience for students and a more dynamic, stimulating learning environment (15, 16).

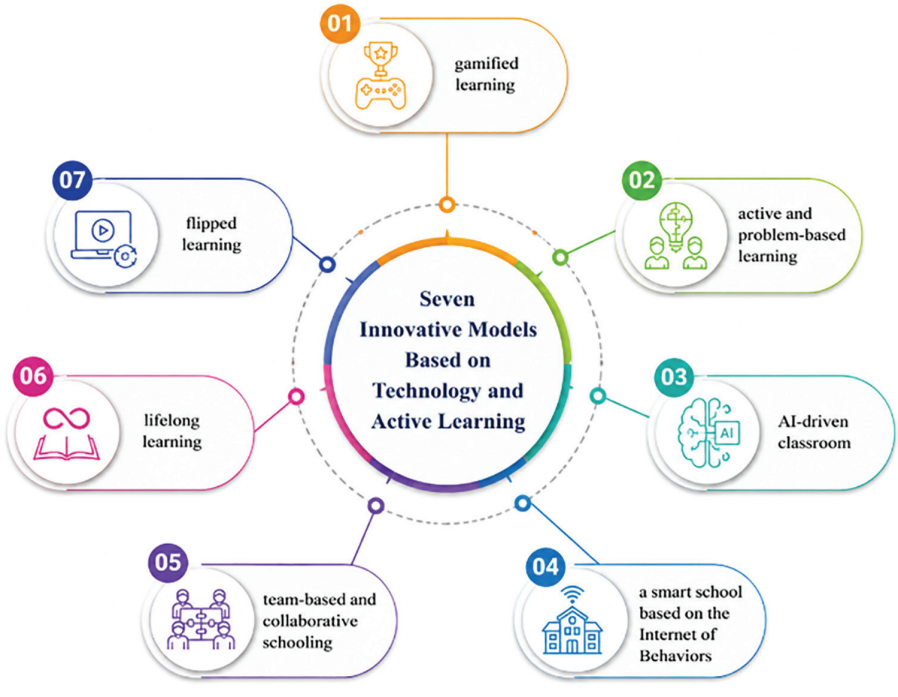

Figure 1. Seven Technology-Based Active Learning Models

Problem-Based Learning (PBL): The second model is "Problem-Based Learning". This framework emphasizes that deep learning occurs when students play an active role in the knowledge construction process. It is grounded in activities such as solving authentic problems, implementing team-based projects, experiential learning, inquiry, experimentation, and sustained student participation (17). Integrating this approach with digital tools, emerging educational technologies such as virtual reality, and using gamification elements can enhance learners' intrinsic motivation while strengthening their engagement, concentration, and sense of ownership over learning (18). Interdisciplinary projects act as learning platforms that help students relate their theoretical knowledge to practical situations (19). Experiential workshops, the adoption of "no-lecture class" days, fieldwork, and the use of real-life challenges at the school or community level help achieve sustainable and effective learning. Apart from improving research skills, this method helps achieve better alignment between school education and the actual needs of society and the job market (20).

AI-driven Classroom: The third model is the "AI-driven Classroom" which has been introduced in many of the world's advanced schools as a second educator; this system can evaluate student performance data, create personal learning paths for students, and develop customized content to meet particular weaknesses of each student, and much more. One of the most important advantages of this type of education is adaptive learning, which increases educational effectiveness and reduces learning gaps (21). Also, the use of smart assistants and educational chatbots enables 24-hour responses to learners' questions and enhances educational interaction.

IoB-based smart school: The fourth innovation is the "IoB-based smart school" model, a smart school based on the Internet of Behavior (IoB) analysis of student data on behavior, learning, and health. Data is gathered through several technologies, including sensors, wearables, learning management systems (LMS), and smart cameras. By analyzing metrics such as attendance, engagement, and physiological well-being, this approach identifies early indicators of stress or disengagement—via facial and ocular tracking—to enable timely interventions before academic failure occurs (22, 23) Smart attendance systems accurately track students' attendance and activities. Also, IoB-based systems can create all the assessments and practice activities needed for each student and provide immediate feedback on student performance to help the students improve (24). LMS platforms create digital learning profiles to track academic performance and personalize learning. Wearables track the learners' health, physical activity, sleep quality, and stress, and suggest educational or well-being needs related to the individual's condition (25). This comprehensive, data-driven model creates intelligent dashboards for teachers, school administrators, and parents, enabling real-time, evidence-based decision-making.

Team-based learning (TBL): The fifth idea for redesigning the educational system is to use the "team-based learning" model. *TBL* is widely used in higher education, particularly in medical education; however, its integration with digital learning ecosystems in school education represents an evolving application. In this approach, learners are not just passive consumers of lessons but are active participants in a *TBL* experience (26). Learners who participate in team-based/participatory efforts can achieve deep and lasting understanding of learning through joint projects, interdisciplinary collaboration, discussion, exchange of ideas, and problem-solving together (27). Participation in teamwork creates a greater sense of belonging among learners and fosters the development and strengthening of skills such as responsibility, critical thinking, and respect for diverse perspectives.

Lifelong learning: The sixth model is "lifelong learning", which is considered a fundamental necessity in the era of transformative technologies. In the educational system, lifelong learning means fostering an attitude in which learners learn not only the course content but also skills that last a lifetime. In this approach, the goal of educational institutions is not only education but also nurturing individuals who can think independently, learn new skills, and adapt to rapid scientific and technological changes (28). In this approach, skills such as critical thinking, problem-solving, flexibility, creativity, teamwork, digital literacy, and financial literacy are also presented to learners. Based on this attitude, students and teachers will never consider themselves finished learners and will be able to continue learning and updating their knowledge and skills after completing their formal education (29).

Flipped learning: Flipped learning, or the "flipped classroom," is the seventh innovative educational model. In this approach, the traditional learning process is shifted so that students study educational content, such as videos, audio files, or lesson texts, at home (30). During class, students and teachers engage in discussions, problem-

Table 1. 3-level Evaluation Dashboard for the Proposed Educational Models

Level	Technological Requirement	Key Indicators	Model	Expected Outcome	Proposed index	Measurement Method	Localization Solution
Level 1: Basic (1-2 years)	Minimal cost; applicable in all schools	- Student participation rate - Attendance rate - Number of team projects completed - Classroom interaction frequency - Problem-solving activities completed - Teacher-reported engagement	Gamified Learning	Increased motivation and engagement	Student motivation; participation rate	Motivated Strategies for Learning Questionnaire (MSLQ); LMS analytics	Begin with low-cost gamification tools in public schools; develop educational games aligned with the national curriculum; prioritize implementation in subjects with low student motivation.
			Problem-Based Learning	Deeper learning and problem-solving skills	Critical, Creative and Systemic Thinking Ability;	Bloom's taxonomy tasks, SOLO rubric	Integrate local community and national challenges (water scarcity, environmental issues, entrepreneurship, public health) into school projects; provide teacher training in PBL methodologies.
			Team-Based Learning	Improved collaboration and communication skills	Teamwork competency	Peer assessment, teamwork rubrics, collaborative project evaluations	Incorporate collaborative projects into existing curricula; use classroom-based group activities that do not require major technological investments; provide teacher facilitation training.
Level 2: Advance (2-3 years)	Moderate digital infrastructure; LMS availability	- LMS login frequency - Learning activity completion rate - Online discussion participation - Digital literacy score - Self-regulated learning indicators	Lifelong Learning	Development of self-directed learning skills	Self-regulated learning score; digital literacy	Self-Regulated Learning Scale; digital competency assessments	Expand access to online learning platforms, vocational upskilling programs, and community learning centers; promote continuous professional development for teachers.
			Flipped Learning	Increased classroom participation and academic achievement	Classroom interaction frequency; course performance	Observation checklists, LMS activity reports, examination scores	Use national educational platform to support pre-class learning; prioritize gradual implementation in secondary schools and higher education.
Level 3: Ideal (4-5 years)	AI, IoB, wearable devices, predictive analytics	-Personalized learning performance - Early warning indicators for disengagement - Stress and well-being metrics - Predictive risk of academic failure - Real-time engagement patterns	AI-Driven Classroom	Personalized learning	Adaptive Learning Achievement	Adaptive LMS analytics, diagnostic tests, predictive AI dashboards	Pilot AI-supported learning platforms in urban schools and universities; establish national guidelines for ethical AI use in education.
			IoB-Based Smart School	Personalized learning, improved well-being	Anxiety score; stress level; attendance consistency	GAD-7, STAI, wearable device data, attendance records	Implement initially in selected smart schools; use existing LMS and attendance systems before adopting advanced wearables; establish strict privacy and data-governance regulations.

solving, group activities, and troubleshooting related to the content learned. In this method, students have more active participation in the educational process. In this approach, the teacher is not only a knowledge transferor, but also a guide and facilitator, helping learners learn how to learn (31).

Evaluation Dashboard

To accommodate education systems at different levels of technology readiness, a 3-level evaluation dashboard is proposed. Table 1 describes the models that can be implemented at each level, as well as the key indicators, expected outcome, proposed index, measurement method, and localization solution for each policy model. This framework enables policymakers to monitor progress based on existing infrastructure and resources, while supporting the gradual shift towards data-driven and smart education systems.

Limitation and Challenges

Although innovative learning and digital teaching can greatly help to enhance learning achievements, these innovative pedagogies are also limited by various drawbacks and situational challenges. Gamified learning can adversely affect intrinsic motivation due to the overuse of extrinsic rewards (32); problem-based learning is often ineffective for beginners who are novice learners who lack domain knowledge (33). In addition, team-based learning can lead to failure if group members do not cooperate or accountability issues occur within the groups (34); also, flipped classroom has limited resources at home with insufficient digital access (35). Beyond that, IoB-based smart school and AI-driven Classroom model involve critical issues that would be the fundamental concerns of feasibility, ethics, and evidence of usage (24, 36). The requirement of financial and human resources needed for smart school infrastructure development (connecting facilities, high-speed Internet, cybersecurity protection, massive storage capacity, sensitive devices, and prolonged teacher training) is always the up-scaling hurdles, especially in developing contexts (24). Furthermore, the security and privacy concerns about tracking students' behavior for monitoring purposes, as well as the possibility of student manipulation with data protection considerations, become critical barriers as well (36). Addressing these challenges to achieve effectiveness is an important direction for future research.

Conclusion

Implementation of these seven innovative educational models, including gamified learning, active and problem-based learning, AI-based classrooms, Internet of Behaviors-based smart schools, team-based and collaborative learning, lifelong learning, and flipped learning, might lead to improvements in some indicators provided that structural barriers are removed beforehand. These models are systematically aligned with the critical challenges outlined for the traditional Iranian educational system. For example, gamified and flipped learning specifically target decreased student engagement and motivation caused by lectures. Problem-based learning and team-based learning focus on developing critical thinking, collaboration, and problem-solving skills by supporting active learning with collaborative knowledge construction. The AI-driven classroom model addresses the lack of personalization and analysis in assessment by providing adaptive learning pathways based on data analysis. An IoB-based smart school aims at students' well-being through tracking early signs of students' lack of engagement, stress, and decreased motivation. Lifelong learning tackles structure and cultural challenges since it can help students develop new skills continuously and adapt quickly to changing needs of society, economy, technology, and culture. In sum, the models create a coherent set of proposed solutions linked to every individual problem.

A critical step in the transition from traditional to intelligent, participatory, and data-driven education is developing a comprehensive roadmap grounded in these models. Year 1 should focus on strategic planning, infrastructure needs assessment, pilot school selection, teacher training, and policy formulation to prepare for the reforms. In Years 2–3, schools can gradually expand the use of PBL, TBL, flipped classroom, cooperative learning, and game-based curricula, along with the first introduction of AI-supported tools, to develop students' interests, critical thinking skills, cooperative learning abilities, and digital skills with the existing school infrastructures. By Years 4–5, the system should move toward optimization using learning analytics, personalized learning paths, and a lifelong learning ecosystem to achieve improvements in academic achievement, well-being, and lifelong success. All these models are valuable tools for this shift, but the data shows that PBL, TBL, and flipped classroom would be cost-effective initial interventions for low-technology-investment school environments, while game-based learning would be an intermediate-level, second stage one. AI-supported classrooms and IoB-based smart schools, due to very high investments in

infrastructure, data governance, and training, are considered as long-term goals for gradual adoption in low-resource environments like Iran. Finally, lifelong learning is considered as an overarching educational goal that underpins and supports the implementation of all the proposed models.

Authors' Contribution

All authors contributed to the discussion, read and approved the manuscript, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

The authors declare no conflicts of interest.

Declaration of AI

Generative AI was used to improve the English language and clarity of the manuscript and to assist in preparing Figure 1. The authors reviewed and approved all AI-assisted content and take full responsibility for the final manuscript.

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