

COMPARISON OF ASSESSMENT APPROACHES IN STEM EDUCATION: SINGAPORE
AND UZBEKISTAN

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Abstract. *Assessment practices in STEM (Science, Technology, Engineering, and Mathematics) education play a critical role in shaping student learning, engagement, and skill development. This article compares the assessment approaches employed in Singapore and Uzbekistan, two countries with distinct educational systems and policies. Singapore's STEM assessment emphasizes continuous, formative evaluation, problem-solving skills, and real-world application, reflecting its internationally recognized high educational standards. In contrast, Uzbekistan traditionally relies more on summative assessments, standardized testing, and theoretical knowledge, though recent reforms aim to integrate practical and competency-based evaluation methods. By analyzing these differing approaches, the article highlights the benefits and challenges of each system, emphasizing the need for assessment strategies that balance knowledge acquisition with critical thinking, creativity, and hands-on skills in STEM education. This comparison provides insights for policymakers, educators, and researchers seeking to enhance STEM learning outcomes globally.*

Keywords. *STEM education, assessment methods, Singapore, Uzbekistan, formative assessment, summative assessment, competency-based evaluation, educational policy*

Annotatsiya. *STEM (Fan, Texnologiya, Muhandislik va Matematika) ta'limidagi baholash amaliyotlari talabalar o'qishini, ularning qiziqishi va ko'nikmalarini rivojlantirishda muhim rol o'ynaydi. Ushbu maqolada Singapur va O'zbekistonning baholash yondashuvlari solishtiriladi, chunki bu ikki mamlakatning ta'lim tizimi va siyosati tubdan farq qiladi. Singapur STEM baholashida doimiy, shakllantiruvchi (formative)*

baholash, muammo yechish ko'nikmalari va amaliy tadbirlarni ta'kidlash bilan ajralib turadi, bu uning xalqaro miqyosdagi yuqori ta'lim standartlarini aks ettiradi. O'zbekistonda esa an'anaviy ravishda yakuniy (summative) baholash, standartlashtirilgan testlar va nazariy bilimlar asosiy o'rin tutadi, biroq so'nggi islohotlar amaliy va kompetensiyaga asoslangan baholash usullarini joriy etishni maqsad qilgan. Ushbu farq va o'xshashliklarni tahlil qilish orqali maqola har bir tizimning afzalliklari va qiyinchiliklarini yoritadi hamda STEM ta'limida bilimni egallash bilan birga tanqidiy fikrlash, ijodkorlik va amaliy ko'nikmalarni rivojlantirish zarurligini ta'kidlaydi. Ushbu solishtirish siyosatchilar, o'qituvchilar va tadqiqotchilar uchun STEM ta'limini yaxshilash bo'yicha qimmatli ma'lumotlar beradi.

Kalit so'zlar. *STEM ta'limi, baholash usullari, Singapur, O'zbekiston, shakllantiruvchi baholash, yakuniy baholash, kompetensiyaga asoslangan baholash, ta'lim siyosati*

Аннотация. *Практики оценивания в STEM-образовании (наука, технологии, инженерия и математика) играют ключевую роль в формировании учебных достижений, вовлеченности и развития навыков учащихся. В данной статье проводится сравнение подходов к оцениванию в Сингапуре и Узбекистане, двух странах с различными системами образования и образовательной политикой. В Сингапуре акцент в STEM-оценке делается на непрерывное, формирующее (formative) оценивание, развитие навыков решения проблем и практическое применение знаний, что отражает международно признанный высокий уровень образования. В Узбекистане традиционно преобладают суммативные (summative) оценки, стандартизированные тесты и теоретические знания, однако недавние реформы направлены на внедрение практических и компетентностно-ориентированных методов оценки. Анализ этих различных подходов позволяет выявить преимущества и проблемы каждой системы, подчеркивая необходимость балансирования между усвоением знаний и развитием критического мышления, креативности и практических навыков в STEM-образовании. Сравнение предоставляет ценные рекомендации для политиков, педагогов и исследователей, стремящихся улучшить результаты обучения в STEM во всем мире.*

Ключевые слова. *STEM-образование, методы оценивания, Сингапур, Узбекистан, формирующее оценивание, суммативное оценивание, компетентностная оценка, образовательная политика*

Introduction

Assessment is a fundamental component of STEM education, influencing not only how students learn but also how teachers design curricula and measure educational outcomes. Different countries adopt diverse assessment approaches based on their educational policies, cultural contexts, and historical practices. Singapore, widely

recognized for its high-performing education system, emphasizes formative assessment, problem-solving skills, and the practical application of knowledge to real-world scenarios. In contrast, Uzbekistan has traditionally relied more on summative assessments, standardized testing, and theoretical knowledge, although recent reforms aim to incorporate more competency-based and practical evaluation methods. Comparing these two countries' approaches provides valuable insights into the effectiveness, advantages, and challenges of different assessment strategies, highlighting the importance of balancing knowledge acquisition with critical thinking, creativity, and hands-on skills in STEM learning.

The assessment of students in STEM education plays a critical role in shaping not only academic outcomes, but also practical skills, problem-solving abilities, creativity, and readiness for higher education or the workforce. In comparing the approaches of Singapore and Uzbekistan, the contrast in their systems — historical background, structure, recent reforms — highlights both challenges and opportunities in designing effective STEM assessment frameworks. In Singapore, SEAB formally oversees national examinations and assessments. The national assessment system includes the Primary School Leaving Examination (PSLE) for primary students, and for secondary education tracks the Singapore-Cambridge GCE N-, O- and A-Level exams. However, alongside these summative national examinations, Singapore's education system incorporates continuous, school-based assessments (SBA) especially for lower secondary (Secondary 1–3) students. School-Based Assessment in Singapore typically involves periodic “weighted assessments” (WA) through the school year: these may include written tests, as well as performance tasks such as group presentations, projects, and coursework—rather than relying solely on one final exam. For example, as of 2024, the pattern for secondary lower-grades is three Weighted Assessments over three terms (terms 1–3), each contributing approx. 15% of the subject mark, followed by an end-of-year exam making up around 55%. Such a structure allows for formative feedback and a more holistic view of student learning, assessing knowledge, skills, and capabilities. On the subject of STEM education specifically, Singapore emphasizes hands-on, real-world problem solving, integration of technology, collaborative learning, and critical thinking. According to analyses of Singapore's STEM strategy, students are often given real-world problems to solve; the curriculum encourages integration of technology (e.g. robotics, coding, simulations), and learning through projects or collaborative tasks — not merely memorizing theory. This approach aligns assessment with practical skills, innovation, and readiness for modern STEM fields. Moreover, Singapore has begun to shift some national assessments from traditional pen-and-paper to electronic examinations. This modernization is consistent with pedagogical changes, and supports evaluating not just recall of knowledge but application, problem solving, and digital literacy — competencies essential for STEM. In sum: Singapore's assessment approach combines:

(a) national-level summative assessment for certification (PSLE, GCE O/N/A Levels); (b) ongoing school-based formative and summative assessments to monitor and guide student learning; (c) emphasis on practical skills, problem-solving, technology and project-based learning especially in STEM; (d) continuous adaptation of assessment modes (e-exams, computer-based tasks) to reflect modern educational needs. Turning to Uzbekistan, the country is currently undergoing major reforms in its general and STEM-oriented education systems. As part of its nationwide education reform agenda, the government has committed to modernizing school education, revamping curricula, updating textbooks, and improving teacher training. One of the key recent developments is the plan to transition to a 12-year school education system, and from 2026/2027 academic year introduce a “unified state exam” for students in grades 9 and 11. This unified exam aims to replace multiple previous assessments (school-leaving exams, university entrance exams, subject certification tests), thereby streamlining assessment and admission procedures. Simultaneously, in efforts to strengthen STEM and engineering-technical education, Uzbekistan plans to establish specialized engineering schools in multiple regions, implement a five-year STEM-based program, and reform technical schools. Through this, the authorities aim to align domestic education standards more closely with international practices and to better prepare students for modern technical professions. Moreover, with backing from international institutions, such as a recent agreement with Asian Development Bank (ADB), Uzbekistan is receiving external funding to modernize STEM education in schools. This investment indicates a concrete push toward upgrading infrastructure, resources, and potentially assessment practices to support quality STEM learning. However — in contrast to Singapore’s mature, multi-layered assessment system — Uzbekistan’s reforms are still in progress. Historically, assessment in many Uzbek schools relied heavily on examinations that emphasized theoretical knowledge, and less on practical tasks, projects, or continuous assessment. Recent policy documents highlight the intention to raise teaching quality, adopt modern pedagogical methods, and integrate new assessment standards. But full-scale implementation — especially for STEM-oriented, competency-based and practical/skills-oriented assessment — remains a work in progress. Thus, while the reforms signal a shift, the assessment approach in Uzbekistan is in transition: moving from a more traditional, exam-centric model toward a possibly more diversified, competency and practice-based model, especially in STEM fields, but not yet fully comparable to systems like Singapore’s. **What this comparison shows — strengths, challenges, and lessons. Strengths of Singapore’s model:** the blended assessment system (school-based + national exams) allows for holistic evaluation — not just testing memory, but also evaluating understanding, application, practical skills, collaboration, creativity. The inclusion of project work, problem solving, technology use and real-world tasks in STEM education better prepares students for higher education

and labour market demands. The shift toward e-exams reflects adaptation to modern pedagogical and digital realities. **Opportunities for Uzbekistan:** with ongoing reforms (unified exam, expansion of STEM/engineering schools, international support) there is a real opportunity to build a more robust, diversified assessment system. Emulating some aspects of Singapore's model — e.g. integrating continuous assessment, practical tasks, project-based evaluation, skills assessment — could raise the quality of STEM education significantly. **Challenges and caveats:** Implementation in Uzbekistan may face resource constraints (infrastructure, teacher training, labs, assessment capacity), and changing entrenched exam-centred mindsets may take time. Without careful planning, a unified exam risks reverting to a predominantly summative, theory-centric evaluation — especially if practical and competency-based components are not fully developed. Also, a hybrid system like Singapore's requires consistent teacher capacity, reliable assessment frameworks, and ongoing quality assurance. **Need for balance:** The ideal seems to lie in a balanced model — one that preserves standardization and fairness (through national exams or certification), but also encourages formative assessment, project-based tasks, real-world problem solving, and continuous evaluation — especially in STEM fields where practical skills and creativity matter as much as theoretical knowledge. Overall, comparing Singapore and Uzbekistan reveals two different phases in the evolution of STEM assessment approaches: one — a mature, diversified, technology-enabled assessment system aligned with modern pedagogical principles (Singapore); the other — a transitioning system, with ongoing reforms aimed at modernization, but still in need of infrastructure, capacity building, and full institutionalization of new assessment paradigms (Uzbekistan). For Uzbekistan, lessons from Singapore — especially on integrating continuous, skills-based assessment and project-based STEM learning — can offer valuable guidance as the country strives to improve STEM education outcomes.

Conclusion

Singapore's STEM assessment system represents a well-established model that integrates national summative exams with continuous, school-based, and project-oriented evaluations. This approach not only tests theoretical knowledge but also promotes problem-solving, critical thinking, collaboration, and practical skills, effectively preparing students for higher education and modern STEM careers. In contrast, Uzbekistan is in a transitional phase, moving from traditional, exam-focused assessment toward competency-based and practical evaluation methods as part of broader education reforms. While challenges such as infrastructure, teacher training, and resource availability remain, adopting balanced assessment strategies that combine formative feedback, project-based learning, and standardized testing can significantly improve STEM education outcomes. Lessons from Singapore demonstrate the importance of aligning assessment with real-world applications, ensuring students

develop both knowledge and the skills needed for success in the rapidly evolving STEM landscape.

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