



وزارة التربية والتعليم والتعليم العالي
Ministry of Education and Higher Education
دولة قطر • State of Qatar



QATAR SCIENCE & TECHNOLOGY SECONDARY SCHOOL FOR BOYS

QSTSS Curriculum Framework September 2024

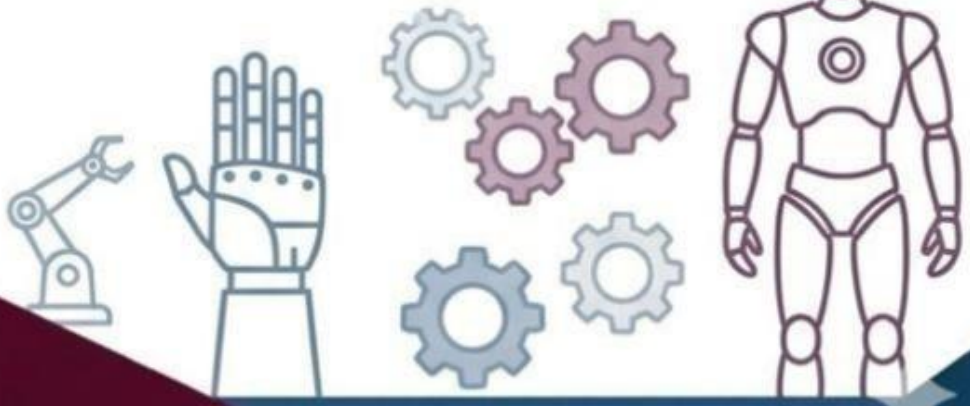
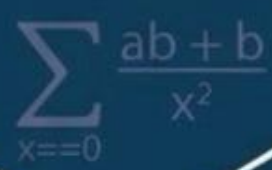
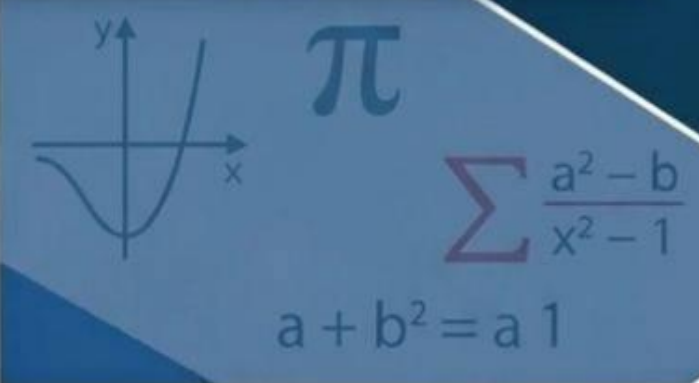


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Framework Overview and Strategic Context

Version: Updated Draft – September 2024

Prepared for: QSTSS Teachers, QSTSS Leadership, MOEHE, and Accreditation Bodies

Status: Approved by QSTSS senior management and academic committee.

This Curriculum Framework outlines the design, implementation, and continuous improvement of the educational program at Qatar Science and Technology Secondary School for Boys (QSTSS). It provides a comprehensive structure that integrates curriculum architecture, teaching and learning, assessment, specialist laboratories, research, innovation, and university readiness pathways.

The framework is designed to align with:

- Ministry of Education and Higher Education (MOEHE) requirements
- Qatar National Vision 2030
- International standards, including NGSS, AP, and global STEM benchmarks
- Accreditation expectations (e.g., Cognition, STEM certification frameworks)

This document should be implemented in conjunction with all current MOEHE regulations, national curriculum requirements, assessment policies, safeguarding frameworks, and school governance guidelines. Where any conflict arises, the prevailing policies and regulations of MOEHE and the State of Qatar shall take precedence.

Key Features of This Edition

- **Establishes a fully integrated curriculum system** linking curriculum design, pedagogy, assessment, innovation, and continuous improvement.
- **Strengthens STEM integration across all subjects**, positioning STEM as an approach to teaching and learning rather than a standalone subject.
- **Introduces a balanced assessment framework**, incorporating diagnostic assessment, formative and summative assessment, and MAP Growth to monitor student progress.
- **Expands specialist laboratory learning**, including digital fabrication, energy systems, robotics, biomedicine, AR/VR, and computer science laboratories.
- **Enhances research, innovation, and project-based learning**, ensuring all students engage in authentic scientific and engineering experiences.
- **Strengthens university readiness pathways**, including AP alignment, research opportunities, and partnerships with higher education institutions.
- **Aligns the curriculum with 21st-century skills, core values, and the Sustainable Development Goals (SDGs)** to ensure global relevance and responsible citizenship.

- **Establishes a structured curriculum review and quality assurance cycle,** supported by data analysis, stakeholder feedback, and accreditation processes.

- **Incorporates expert-informed curriculum design,** including the contribution of Dr. Thomas Hsu in the development of the Grade 9–10 STEM program.

Guiding Principle

The QSTSS Curriculum Framework is based on the principle that:

High-quality STEM education must be rigorous, relevant, experiential, and continuously evolving to meet the demands of a rapidly changing world.

Implementation Note

This framework is a **living document** and will be reviewed and updated periodically based on:

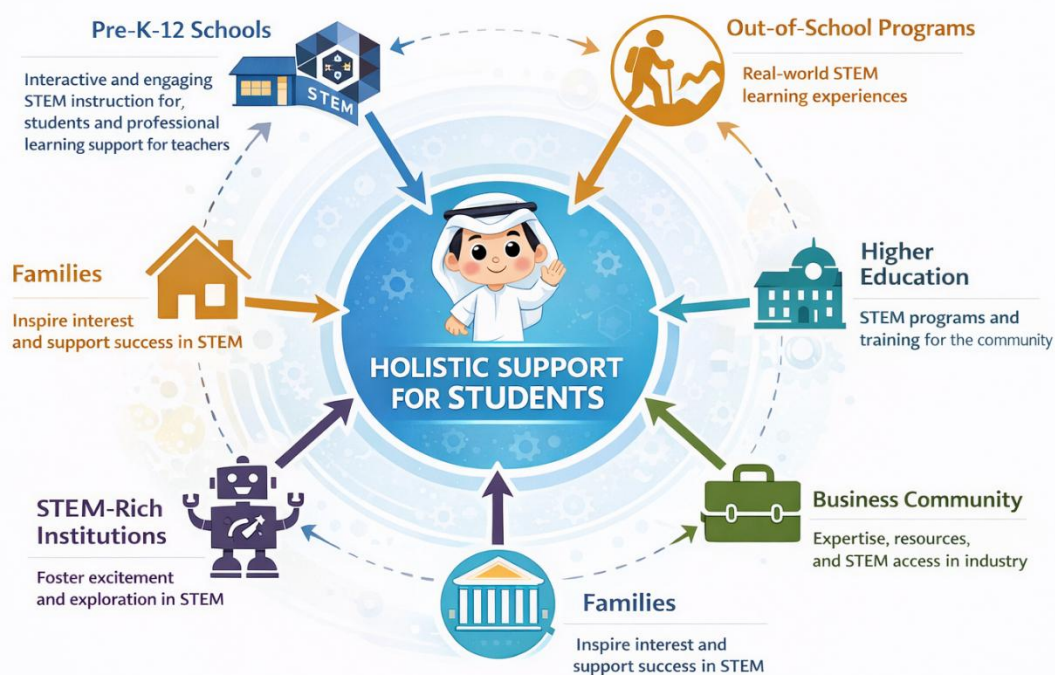
- student performance data and MAP Growth analysis
- stakeholder feedback (students, staff, parents, partners)
- internal curriculum reviews and external accreditation findings
- emerging educational research and national priorities

Item	Details
Title	QSTSS Curriculum Framework
Version	Updated version (3)– September 2024
Supersedes	Previous curriculum frameworks, guidelines, and internal curriculum planning documents (as applicable)
Owner	School Leadership – Academic Affairs (Curriculum & Instruction)
Approval Authority	School Director and relevant MOEHE authorities
Review Cycle	Biennial review aligned with the school improvement cycle, or earlier in response to MOEHE directives, accreditation requirements, or data-driven curriculum review findings

Section 1: Introduction and Purpose of the Framework

Qatar Science and Technology Secondary School for Boys (QSTSS) is a specialized government STEM school operating under the Ministry of Education and Higher Education (MOEHE). Since its establishment in August 2018, the school has served as a pioneering national model for high-quality STEM education, offering a rigorous and transdisciplinary learning experience that equips students with the knowledge, skills, values, and dispositions needed to thrive in an increasingly complex and rapidly changing world.

QSTSS is committed to delivering an innovative curriculum that integrates science, technology, engineering, and mathematics through authentic, hands-on, inquiry-based, and problem-centered learning experiences. The school places strong emphasis on creativity, critical thinking, research, design, innovation, and ethical responsibility, enabling students to apply their learning to meaningful local, regional, and global challenges through advanced technologies and modern scientific practices. These experiences are enriched through specialized laboratories, interdisciplinary projects, and partnerships with universities, industry, and the wider community.



The revised QSTSS Curriculum Framework 2024 builds on the foundations of the 2022 version while responding to emerging educational priorities, national aspirations, and global developments. This revised framework strengthens curriculum design and implementation through the intentional integration of the Sustainable Development Goals (SDGs), research and innovation, ethics and values, artificial intelligence (AI), and university and career readiness across learning areas and student experiences. These enhancements are designed to deepen student learning, improve outcomes, foster responsible and future-ready graduates, and reinforce readiness for higher education, research pathways, and participation in a knowledge-based economy.

This framework serves as the school’s authoritative reference for curriculum design, delivery, assessment, enrichment, and review. It establishes the principles, structures, expectations, and quality indicators that guide curriculum planning and implementation across Grades 9–12. It also clarifies how QSTSS interprets national priorities and international best practice within a specialized STEM context.

A central principle underpinning the QSTSS curriculum is that effective STEM education must connect learning to authentic real-world contexts, interdisciplinary inquiry, and future-oriented applications. Accordingly, QSTSS extends learning beyond the classroom by actively engaging with external partners and building a broader STEM ecosystem that includes families, universities, research institutions, industry, and community organizations. Through this ecosystem approach, students benefit from enriched opportunities that reinforce academic excellence, innovation, ethical awareness, sustainability, and the competencies required for success in university and beyond.

Key Enhancements in the Revised Framework

- Stronger integration of the Sustainable Development Goals (SDGs) and sustainability education.
- More explicit emphasis on research, innovation, and inquiry across all grade levels.
- Integration of artificial intelligence (AI), digital fluency, and responsible technology use.
- Reinforcement of ethics, Islamic values, national identity, and responsible citizenship.
- Stronger focus on university readiness, future careers, and 21st century competencies.
- Closer alignment with continuous improvement priorities, accreditation expectations, and quality assurance processes.

Section 2: Vision, Mission, Values, and Strategic Curriculum Goals

The vision, mission, values, and goals of Qatar Science and Technology Secondary School for Boys (QSTSS) are aligned with those of the Ministry of Education and Higher Education (MOEHE) and have been contextualized to reflect the school’s specialized STEM identity, national role, and educational aspirations. Together, they provide the strategic and ethical foundation of the curriculum and guide all aspects of curriculum design, teaching and learning, assessment, student development, and school improvement.

At QSTSS, the curriculum is not viewed merely as a collection of subjects and courses, but as a coherent educational experience intentionally designed to develop knowledgeable, capable, ethical, innovative, and future-ready learners. The school’s vision, mission, values, and strategic goals therefore serve as the central reference points for curricular decision-making and for the development of a learning culture that promotes excellence, innovation, responsibility, and contribution to national development.



2.1 Vision

Entrepreneurial Learners for Sustainable Development

This vision reflects QSTSS’s commitment to preparing students who are not only academically strong in STEM disciplines, but also capable of thinking creatively, acting responsibly, and contributing meaningfully to a sustainable and knowledge-based future. It emphasizes the development of entrepreneurial mindsets, initiative, adaptability, and problem-solving capacities that enable students to respond effectively to emerging challenges and opportunities at local, national, and global levels.

Within the curriculum, this vision is translated into learning experiences that promote innovation, design thinking, inquiry, sustainability awareness, ethical decision-making, and the application of knowledge to authentic contexts. It also reinforces the school’s responsibility to prepare students for future study, future careers, and future leadership.

2.2 Mission

To establish an inclusive and innovative educational environment that enhances values and ethics, equipping learners with high-level skills to prepare a conscious generation capable of building an advanced society and a thriving economy.

The QSTSS mission expresses the school's commitment to providing a high-quality, inclusive, and future-oriented educational experience in which academic excellence is developed alongside character, ethics, and social responsibility. The mission underscores that strong STEM education must be supported by an enabling environment that nurtures intellectual growth, creativity, responsibility, communication, collaboration, and respect for values.

In curriculum terms, this mission requires QSTSS to provide rigorous and engaging learning experiences, well-structured support systems, rich opportunities for practical and interdisciplinary application, and a strong culture of innovation and continuous improvement. It also affirms the school's role in preparing students to contribute productively to Qatar's development and to participate successfully in higher education, research, and the future workforce.

2.3 Core Values

The core values of QSTSS shape the ethos of the school and inform the way the curriculum is designed, delivered, experienced, and evaluated. These values are embedded across academic learning, student life, enrichment opportunities, research activities, partnerships, and professional practice.

Responsibility: QSTSS promotes responsibility by encouraging students to take ownership of their learning, conduct themselves with integrity, and contribute positively to their school, community, and nation. Within the curriculum, responsibility is reflected in independent learning, ethical research practices, safe laboratory conduct, digital citizenship, and commitment to sustainability.

Excellence: QSTSS strives for excellence in all aspects of teaching, learning, innovation, and student achievement. The curriculum is therefore designed to maintain high expectations, academic rigor, and ambitious standards while supporting students to achieve their full potential.

Quality: Quality is reflected in the school's commitment to coherent curriculum design, effective pedagogy, robust assessment practices, continuous review, and evidence-based improvement. This value reinforces the importance of consistency, high standards, and institutional effectiveness across all curriculum processes.

Innovation: Innovation is central to the QSTSS educational model. The curriculum encourages curiosity, experimentation, invention, creative problem-solving, design thinking, and the application of emerging technologies, including artificial intelligence, in meaningful and responsible ways.

Effective Communication: QSTSS values clear, purposeful, and respectful communication in all contexts. The curriculum therefore supports the development of communication skills across languages, disciplines, and formats, including scientific writing, presentations, discussion, collaboration, research communication, and engagement with diverse audiences.

2.4 Strategic Curriculum Goals

The QSTSS curriculum is designed to advance a set of strategic goals that translate the school's vision and mission into clear educational outcomes and institutional priorities.

1. To provide learning outcomes that develop 21st century skills and support the development of a knowledge-based national economy.

The curriculum aims to equip students with the competencies required for success in a rapidly changing world, including critical thinking, creativity, communication, collaboration, digital fluency, adaptability, research capability, and responsible innovation. These competencies are essential for participation in higher education, emerging industries, and Qatar's long-term national development.

2. To deliver high-quality educational experience in science, technology, engineering, and mathematics.

As a specialized STEM school, QSTSS is committed to delivering a rigorous, integrated, and future-focused curriculum that ensures strong disciplinary foundations while also promoting interdisciplinary application, practical inquiry, design, and innovation.

3. To prepare students to join leading universities and to develop into distinguished scientists, researchers, inventors, and future leaders.

The curriculum is designed to build strong academic foundations, advanced subject knowledge, research skills, and independent learning habits that support university readiness and long-term success in STEM-related fields. This includes preparation for competitive higher education pathways, scholarly inquiry, and participation in research and innovation environments.

4. To reinforce Islamic values, national identity, ethics, and responsible citizenship among students.

QSTSS recognizes that excellence in STEM education must be grounded in strong moral, cultural, and civic foundations. Accordingly, the curriculum seeks to strengthen ethical awareness, respect for Islamic principles, commitment to national identity, appreciation of Qatari values, and a sense of responsibility toward society and sustainable development.



2.5 Implications for Curriculum Design and Implementation

The vision, mission, values, and goals of QSTSS are not treated as symbolic statements; rather, they are operationalized through the structure and experiences of the curriculum. Their influence is reflected in:

- The design of rigorous and relevant STEM learning experiences.
- The integration of ethics, values, sustainability, and national identity across the curriculum.
- The promotion of research, innovation, entrepreneurship, and future-readiness.
- The development of communication, leadership, and collaboration skills.
- The use of specialized laboratories, projects, and community partnerships to enrich learning; and
- The continuous review of curriculum quality and student outcomes in alignment with the school's strategic direction.

Section 3: The aims of the QSTSS Curriculum Framework

The QSTSS Curriculum Framework is intended to provide a clear, coherent, and future-oriented foundation for curriculum design, implementation, review, and continuous improvement across the school. It establishes a shared institutional reference point for what students are expected to learn, how learning is organized and delivered, how learning is assessed, and how curriculum quality is monitored over time within a specialized STEM context.

As a strategic curriculum document, the framework is designed not only to define curriculum content and structure, but also to guide decision-making, ensure consistency, strengthen educational quality, and support the continuous development of student outcomes in alignment with the school's vision, mission, values, and goals.

The aims of the QSTSS Curriculum Framework are to:

3.1 Provide coherence and clarity for curriculum planning and delivery

- provide a coherent whole-school framework for the planning, organization, delivery, and review of the curriculum across Grades 9–12.
- clarify the structure, architecture, and progression of the curriculum within a specialized STEM school model; and
- ensure a shared understanding among leaders, teachers, engineers, and other stakeholders of the principles that underpin curriculum design and implementation.

3.2 Define curriculum content, learning expectations, and progression

- define the curriculum in terms of subject content, subject-specific skills, STEM-related competencies, interdisciplinary learning, and transferable skills.
- identify the essential knowledge, understanding, skills, values, and dispositions students are expected to develop by the end of their secondary education at QSTSS; and
- establish an organized and progressive set of learning expectations and standards that support continuity, rigor, and readiness for higher education and future pathways.

3.3 Strengthen integration, alignment, and quality of learning

- define the curriculum architecture required to support integrated, multidisciplinary, and interdisciplinary approaches to learning appropriate for a STEM school.
- ensure consistency and alignment between intended learning outcomes, curriculum content, pedagogy, student learning experiences, assessment practices, and actual learning outcomes; and
- promote balance between academic rigor, practical application, innovation, ethics, values, sustainability, and student well-being.

3.4 Guide assessment, evaluation, and evidence-based improvement

- provide a foundation for the design and implementation of both formative and summative assessment strategies.
- establish principles for evaluating current and future decisions related to curriculum content, structure, delivery, and resourcing.
- provide criteria, indicators, and reference points for curriculum evaluation, review, revision, and quality assurance; and
- support the evaluation of school effectiveness through evidence of curriculum implementation, student achievement, and institutional impact.

3.5 Support professional learning, innovation, and future development

- inform continuing professional development policies and programs related to curriculum design, pedagogy, assessment, STEM integration, research, innovation, and emerging educational priorities.
- support the ongoing development of the QSTSS curriculum in response to national priorities, global trends, and future-readiness requirements, including artificial intelligence, sustainability, ethics, and research.
- provide a strong reference for internal quality assurance, accreditation, and school improvement processes; and
- facilitate the adaptation and transfer of the QSTSS curriculum model to future STEM schools in the State of Qatar.

Section 4: National and Strategic Context

The QSTSS Curriculum Framework is developed within the broader context of Qatar’s national educational aspirations, reform priorities, and long-term development agenda. As a specialized STEM school operating under the Ministry of Education and Higher Education (MOEHE), QSTSS is expected not only to meet national curriculum requirements, but also to contribute meaningfully to Qatar’s ambition to build a sustainable, knowledge-based economy driven by education, research, innovation, and human development.

This national and strategic context is particularly important for QSTSS because the school’s curriculum is designed to prepare students for advanced study, future careers, responsible citizenship, and leadership in fields that are critical to Qatar’s continued development. Accordingly, the curriculum framework is aligned with both the **Qatar National Vision 2030 (QNV 2030)** and the **Qatar National Curriculum Framework (QNCF)**.

4.1 Alignment with the Qatar National Vision 2030

Qatar National Vision 2030 positions human development at the heart of national progress and emphasizes the importance of high-quality education and training in preparing citizens to contribute effectively to society and the economy. The vision highlights the need for an education system that equips learners with the knowledge,

skills, values, and capabilities required to meet labour market needs, fulfil individual potential, and support sustainable national advancement.

Within this context, QSTSS contributes directly to the realization of QNV 2030 by offering a specialized STEM curriculum that promotes academic excellence, innovation, research capability, technological fluency, and future readiness. The school's curriculum is intentionally designed to support Qatar's aspiration to strengthen its position as a knowledge-based economy through the development of learners who are capable of inquiry, invention, entrepreneurship, and responsible participation in a rapidly evolving world.

The alignment between the QSTSS curriculum and QNV 2030 is reflected in several key dimensions:

- the development of strong scientific, technological, mathematical, and research competencies;
- the promotion of innovation, problem-solving, and entrepreneurial thinking;
- the integration of sustainability, responsible citizenship, and ethical awareness;
- the preparation of students for higher education, advanced study, and emerging future sectors; and
- the cultivation of learners who can contribute to national development through knowledge, creativity, and leadership.

In this way, QSTSS serves as a practical and strategic educational response to Qatar's long-term aspirations by preparing students not only for academic success, but also for meaningful participation in a sustainable and innovation-driven future.

4.2 Alignment with the Qatar National Curriculum Framework (QNCF)

The QSTSS curriculum is fully aligned with the Qatar National Curriculum Framework (QNCF), which provides the national reference for curriculum values, aims, principles, and expected learning outcomes in Qatari schools. While QSTSS offers a specialized STEM model with distinctive structures, laboratories, and enrichment opportunities, it remains firmly grounded in the expectations and requirements of the national curriculum framework.

The QNCF identifies a set of core values that are highly relevant to the QSTSS context, including:

- respect and compassion;
- positivity and endeavor; and
- personal rights, responsibility, and integrity.

These values are reflected in the QSTSS curriculum through the emphasis placed on ethical conduct, collaboration, responsibility, perseverance, respect for others, and positive engagement in learning and community life.

The QNCF also identifies several overarching aims that are strongly aligned with the QSTSS educational model, including:

- successful lifelong learning;
- personal, moral, and social development; and
- active and responsible citizenship.

These aims are embedded in the QSTSS curriculum through a learning experience that combines academic rigor with personal development, ethical education, interdisciplinary application, and preparation for participation in society, higher education, and future careers.

In addition, the QNCF is underpinned by a set of curriculum principles that are particularly relevant to curriculum design at QSTSS:

- **Excellence** – reflected in high expectations, academic rigor, and ambitious outcomes for all learners;
- **Inclusiveness** – reflected in the commitment to high-quality learning opportunities, support, and access for all students;
- **Openness and flexibility** – reflected in curriculum responsiveness, innovation, and the integration of emerging priorities and opportunities;
- **Balance** – reflected in the curriculum’s attention to academic, practical, ethical, social, and personal development;
- **Relevance** – reflected in the real-world application of learning and the connection between curriculum content and authentic contexts; and
- **Integration and coherence** – reflected in the interdisciplinary, connected, and progressively structured nature of the QSTSS curriculum.

By aligning with these values, aims, and principles, the QSTSS Curriculum Framework ensures that its specialized STEM provision remains fully compatible with national expectations while also extending students’ learning through enhanced opportunities in research, innovation, advanced study, and practical application.

4.3 National Requirements, Graduation, and Additional Qualifications

Students who successfully engage with the QSTSS curriculum are expected to satisfy the national requirements applicable to secondary education in Qatar while also benefiting from the distinctive features of the school’s specialized STEM model. The curriculum is therefore designed to ensure that students meet the standards and graduation requirements expected within the national system, while at the same time accessing enhanced pathways that strengthen their academic profile and future readiness.

Successful graduates of QSTSS receive the **Specialized Education High School Certificate**. In addition, students are supported to pursue a range of recognized international qualifications and readiness measures, which may include **Advanced Placement (AP) courses, SAT, and IELTS**, according to school pathways, student aspirations, and institutional planning.

This combination of national compliance and enriched academic opportunity is a defining feature of the QSTSS curriculum. It allows the school to maintain full alignment with the national education system while also preparing students competitively for

higher education, scholarships, selective university admission, and future engagement in STEM-related fields.

4.4 Implications for the QSTSS Curriculum

The national and strategic context outlined above has direct implications for the design and implementation of the QSTSS curriculum. It requires the school to maintain a curriculum that is:

- aligned with national values, expectations, and graduation requirements;
- ambitious in academic quality and future-oriented in design;
- responsive to national priorities related to innovation, sustainability, and human development;
- supportive of ethical, civic, and personal development;
- compatible with pathways to higher education and international benchmarks; and
- sufficiently flexible to evolve in response to educational reform, technological change, and future national needs.

For QSTSS, alignment with QNV 2030 and the QNCF is therefore not a matter of compliance alone, but a strategic commitment to ensuring that curriculum design serves both national priorities and the long-term success of students.



Section 5: The QSTSS Curriculum Model

The QSTSS Curriculum Model translates the school’s vision, mission, values, and strategic goals into a coherent educational design for teaching, learning, assessment, and student development. It provides the conceptual foundation for how the curriculum is organized and how students experience learning across Grades 9–12 within a specialized STEM context.

The model is intentionally designed to combine disciplinary rigor with interdisciplinary application, innovation, ethical responsibility, and future readiness. It reflects the school’s commitment to preparing students who are not only academically successful, but also capable of inquiry, research, collaboration, leadership, responsible decision-making, and meaningful contribution to society. In this sense, the curriculum model is both academically ambitious and educationally holistic.

In the revised framework, the QSTSS Curriculum Model is shaped by four interrelated design principles, a set of cross-cutting curriculum pillars, and a learner profile that defines the key competencies and dispositions students are expected to develop by the time they graduate.

5.1 Design Principles

Using a STEM education framework, QSTSS seeks to cultivate a distinctive approach to teaching and learning that develops creativity, innovation, inquiry, and applied problem-solving in all students. The curriculum is therefore built on four core design principles that shape curriculum planning, pedagogy, student engagement, and the overall learning culture of the school.

5.1.1 Embracing a culture of inquiry, discovery, design, and communication

Students are naturally curious and seek to make sense of the world through observation, questioning, experimentation, reflection, and interaction with their environment. Accordingly, the QSTSS curriculum promotes a culture of inquiry in which students are encouraged to ask meaningful questions, investigate authentic issues, test ideas, and communicate their understanding in a variety of forms.

This principle also emphasizes the design process as a key structure for learning. Teachers are expected to incorporate design thinking, investigation, analysis, prototyping, reflection, and communication into learning experiences across subjects and grade levels. Students are not seen as passive recipients of information; rather, they are positioned as active participants and designers of their own learning.

5.1.2 Addressing real-world issues through project-based and transdisciplinary learning

QSTSS is committed to a learner-centered curriculum that places relevant issues, authentic contexts, and real-world problems at the center of instructional design. Learning is therefore contextualized, purposeful, and application-oriented. Students

are expected not only to acquire knowledge, but also to use it in meaningful ways through project-based learning, design challenges, investigations, and performance tasks.

A transdisciplinary approach is an important feature of the QSTSS model. Students are encouraged to make connections across disciplines, apply learning to complex challenges, and understand how knowledge from different fields can be integrated to generate insight and solutions. In this model, the learning process is valued alongside the learning outcomes, and students are expected to document, reflect upon, and communicate their learning journey through presentations, portfolios, exhibitions, and evidence-based discussion.

5.1.3 Working and learning together through collaboration and community engagement

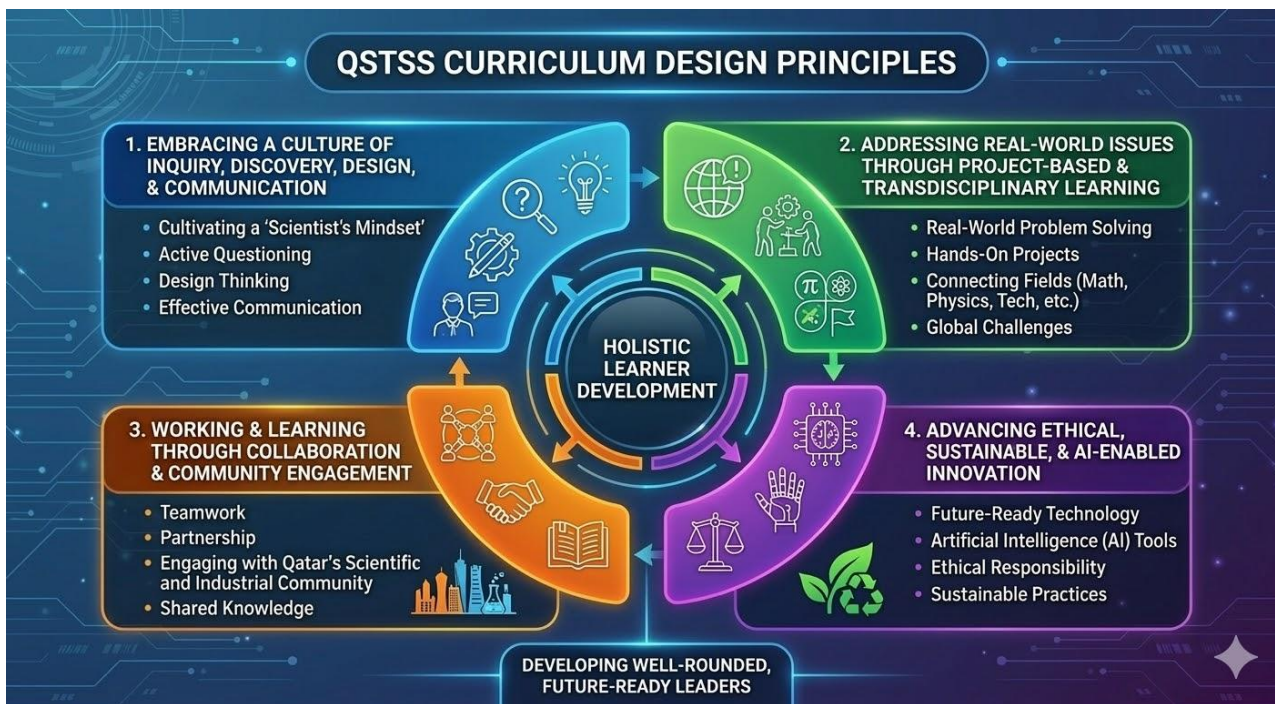
QSTSS recognizes that deep learning is strengthened through collaboration, dialogue, shared practice, and engagement with others. Students and staff therefore learn by doing, sharing, questioning, and connecting within a wider community of practice. Collaboration is promoted within classrooms, across departments, between disciplines, and through partnerships beyond the school.

This principle extends learning beyond classroom walls by engaging families, universities, industry partners, research institutions, and community organizations in the educational experience. Through internships, mentorships, service learning, enrichment programs, and collaborative projects, students are given opportunities to participate in authentic contexts and to understand the relevance of their learning within society.

5.1.4 Advancing ethical, sustainable, and AI-enabled innovation

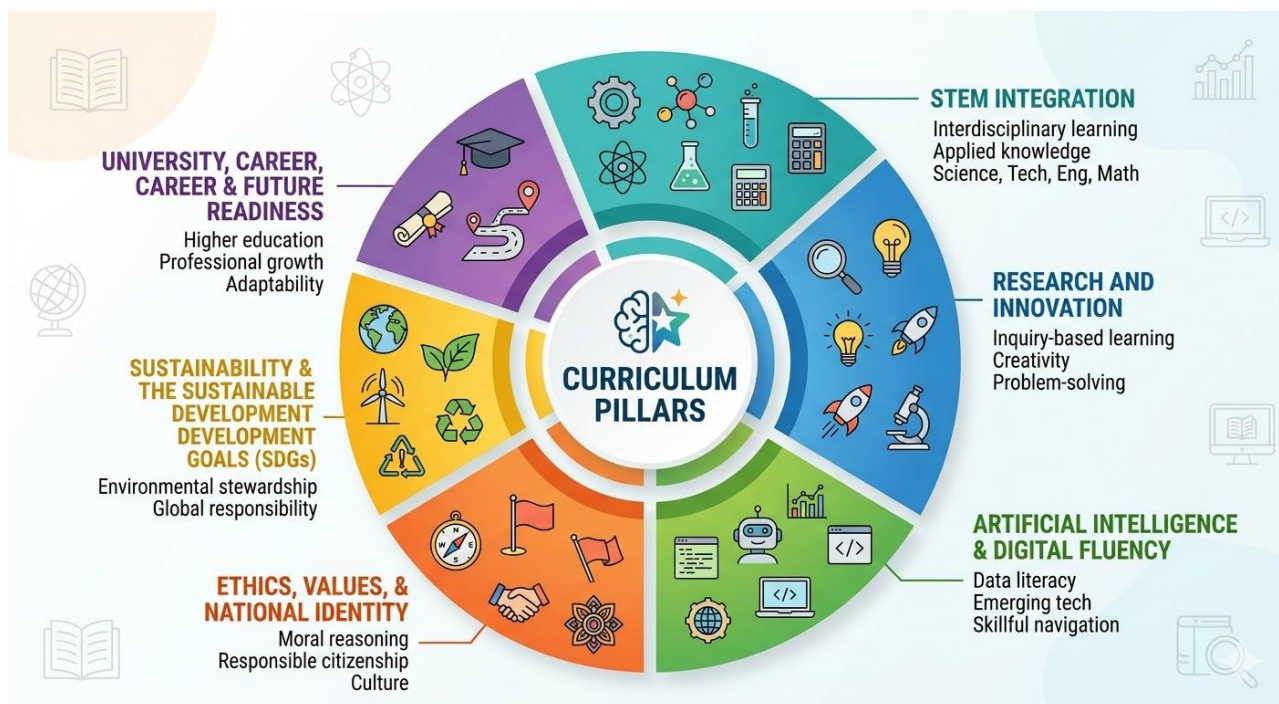
As a revised and future-oriented curriculum framework, QSTSS places strong emphasis on ensuring that innovation is guided by ethics, values, sustainability, and responsible use of technology. Students are expected not only to innovate, but to do so thoughtfully, ethically, and with awareness of the wider human, social, and environmental implications of their decisions.

This principle supports the integration of Islamic values, national identity, ethical reasoning, sustainability education, the Sustainable Development Goals (SDGs), and artificial intelligence (AI) across the curriculum. It also reinforces the expectation that students should become responsible digital citizens who can engage critically with technology, use AI in informed and ethical ways, and apply their learning to support sustainable development and human well-being.



5.2 Curriculum Pillars

The QSTSS Curriculum Model is further strengthened through a set of cross-cutting curriculum pillars that shape learning experiences across subjects, projects, laboratories, and enrichment opportunities. These pillars give practical expression to the school's strategic priorities and ensure that important themes are embedded consistently throughout the curriculum.



5.2.1 STEM integration

The curriculum is designed to promote meaningful integration across science, technology, engineering, and mathematics while preserving the disciplinary rigor of each field. Students are encouraged to understand how concepts and methods from different disciplines connect and how integrated knowledge can be applied to real-world situations.

5.2.2 Research and innovation

Research and innovation are central to the QSTSS educational model. The curriculum progressively develops students' abilities to inquire, investigate, analyze evidence, design solutions, test ideas, and communicate findings. These capacities are strengthened through classroom inquiry, specialist laboratory work, design challenges, research projects, and innovation-focused experiences.

5.2.3 Artificial intelligence and digital fluency

The revised framework recognizes the growing importance of artificial intelligence, computational thinking, digital tools, and data literacy in education and society. The curriculum therefore supports the development of digital fluency and responsible AI use, including the ability to use digital technologies effectively, evaluate information critically, engage safely and ethically in digital environments, and understand the opportunities and risks associated with emerging technologies.

5.2.4 Ethics, values, and national identity

QSTSS affirms that high-quality STEM education must be grounded in strong ethical, cultural, and civic foundations. The curriculum therefore reinforces Islamic values, national identity, responsibility, integrity, respect, compassion, and ethical conduct. These elements are embedded not only in specific subjects, but also in the wider learning culture, research practices, collaborative work, and student decision-making.

5.2.5 Sustainability and the Sustainable Development Goals (SDGs)

The curriculum promotes sustainability awareness and encourages students to understand the relationship between scientific advancement, human development, environmental stewardship, and social responsibility. Through this pillar, students explore local and global issues, engage with the SDGs, and consider how STEM knowledge and innovation can contribute to sustainable development.

5.2.6 University, career, and future readiness

The QSTSS curriculum is intentionally designed to prepare students for successful transition to higher education, future careers, and lifelong learning. This includes the development of advanced academic knowledge, research capabilities, communication skills, independence, resilience, adaptability, leadership, and readiness for demanding university and professional pathways.

5.3 Learner Profile and Graduate Competencies

The QSTSS Learner Profile defines the core competencies, attributes, and dispositions that the curriculum seeks to develop in all students. It provides a shared description of what successful QSTSS learners should know, be able to do, and value by the end of their secondary education.

Students graduating from QSTSS are expected to become:

5.3.1 Critical and creative thinkers

Students use critical and creative thinking to analyze information, interpret evidence, generate ideas, evaluate alternatives, and respond thoughtfully to real-life challenges and opportunities.

5.3.2 Effective communicators and collaborators

Students express themselves clearly, confidently, and purposefully in a variety of spoken, written, visual, and digital forms. They work productively with others, listen actively, share responsibility, and contribute constructively to collective goals.

5.3.3 Problem solvers and decision-makers

Students approach problems with resilience, logic, creativity, and openness. They view challenges as opportunities for learning and innovation, and they make informed decisions based on evidence, reflection, and ethical consideration.

5.3.4 Inquirers and researchers

Students are curious, reflective, and motivated to investigate questions independently and collaboratively. They possess the skills needed to conduct inquiry, gather and analyze information, evaluate sources, and communicate research findings effectively.

5.3.5 Innovators and designers

Students use design thinking, experimentation, and iterative improvement to generate new ideas, develop solutions, and create meaningful products, systems, or responses to challenges.

5.3.6 STEM-literate individuals

Students apply concepts, practices, and methods from science, technology, engineering, and mathematics to understand complex issues and contribute to solving them through informed and integrated approaches.

5.3.7 Digitally and AI-literate individuals

Students use digital technologies confidently, critically, and responsibly. They can access, evaluate, create, and communicate information across digital platforms and

understand the role, uses, limitations, and ethical implications of artificial intelligence and emerging technologies.

5.3.8 Disciplined and responsible individuals

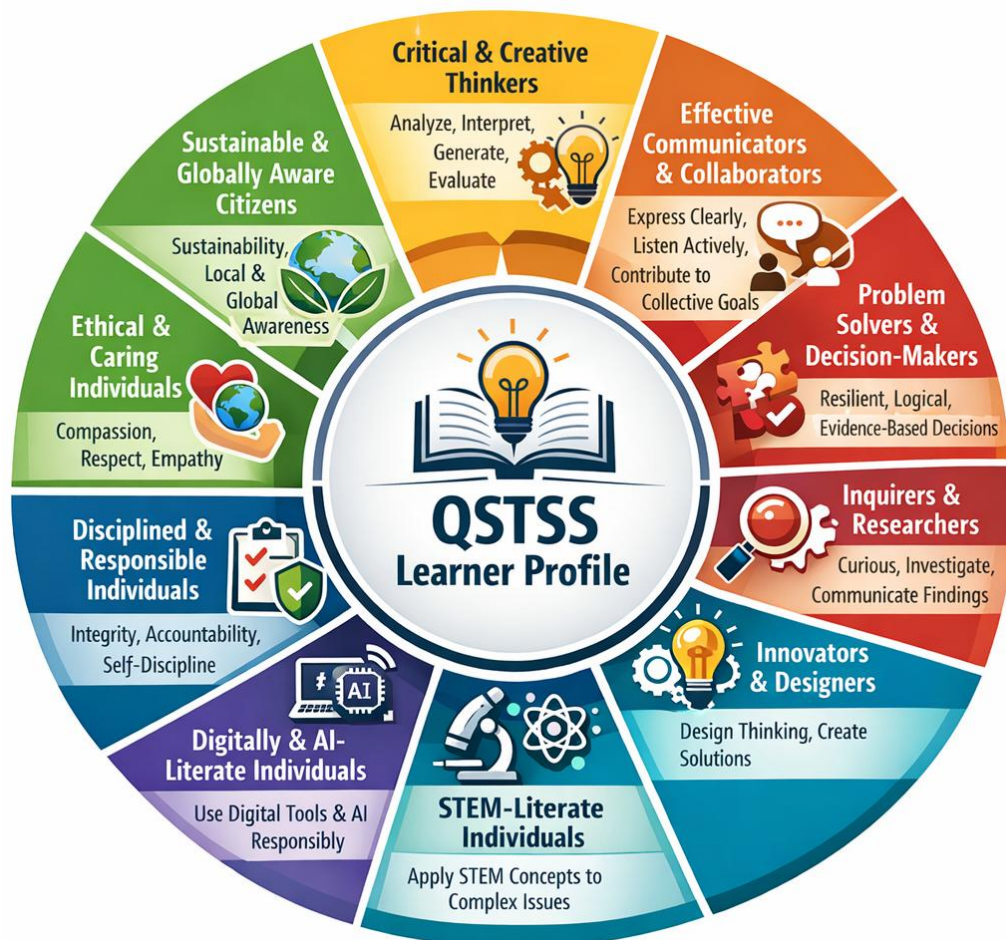
Students act with integrity, honesty, fairness, accountability, and self-discipline. They take responsibility for their actions, learning, conduct, and the impact of their decisions on others and on the wider community.

5.3.9 Ethical and caring individuals

Students demonstrate Islamic and universal human values, compassion, respect, empathy, and a commitment to making a positive difference in the lives of others.

5.3.10 Sustainable and globally aware citizens

Students understand the importance of sustainability, stewardship, and responsible citizenship. They are aware of local and global challenges, appreciate their responsibilities toward society and the environment, and seek to contribute positively to a more sustainable and just future.



5.4 Implications for Curriculum Design and Student Experience

The QSTSS Curriculum Model has direct implications for the way teaching and learning are planned and experienced across the school. It requires the curriculum to:

- promote both disciplinary depth and interdisciplinary connection;
- provide authentic, inquiry-based, and project-based learning experiences;
- integrate research, innovation, digital fluency, AI, ethics, values, and sustainability across subject areas;
- support progression in knowledge, skills, and competencies across Grades 9–12;
- offer rich opportunities for laboratory work, design, presentation, reflection, and collaboration; and
- prepare students for higher education, research pathways, responsible citizenship, and future careers.

Section 6: Curriculum Architecture and Content

The curriculum architecture and content at Qatar Science and Technology Secondary School for Boys (QSTSS) are intentionally designed to reflect the school’s identity as a specialized STEM school and its commitment to developing knowledgeable, innovative, ethical, and future-ready learners. The curriculum is not conceived as a collection of separate subjects delivered in isolation; rather, it is a coherent and integrated framework that combines disciplinary rigor, interdisciplinary STEM learning, practical application, research, innovation, values-based education, and preparation for higher education and future careers.

At QSTSS, curriculum architecture refers to the overall structure, organization, progression, and integration of learning across grade levels, subject domains, and learning experiences. Curriculum content refers to the essential knowledge, concepts, skills, values, attitudes, and competencies that students are expected to develop through this structure. Together, they define the learning journey of the school and ensure that education is purposeful, progressive, relevant, and aligned with the school’s vision, mission, learner profile, and strategic priorities.

A central feature of the QSTSS curriculum is that **STEM is not treated as a separate curriculum or a standalone program detached from the rest of learning**. Rather, STEM is infused across the curriculum as an interdisciplinary approach that connects science, technology, engineering, mathematics, research, innovation, digital fluency, problem-solving, and real-world application. This means that students are expected not only to acquire subject knowledge, but also to apply that knowledge critically, creatively, collaboratively, and ethically to understand and address authentic challenges.

The curriculum therefore moves beyond traditional subject compartmentalization. It is designed to create meaningful connections across learning areas, promote practical and hands-on experiences, embed the Sustainable Development Goals (SDGs), strengthen ethics and values, develop 21st century skills, and prepare students for

advanced study, responsible citizenship, and purposeful contribution in an increasingly complex and rapidly changing world.

6.1 Purpose and Intent of the Curriculum Architecture

The curriculum architecture at QSTSS is designed to provide all learners with a coherent, challenging, and future-oriented educational experience that supports both academic excellence and holistic development. It ensures that students progress through a structured learning journey in which knowledge, skills, values, and competencies are developed in an increasingly integrated, applied, and sophisticated manner.

The curriculum is intended to:

- provide a clear and progressive structure across Grades 9 to 12;
- ensure strong foundations in core academic disciplines;
- embed STEM thinking, practices, and applications across the curriculum;
- promote interdisciplinary and transdisciplinary learning around authentic issues and challenges;
- provide practical, experimental, design-based, and research-based learning experiences;
- integrate ethics, values, sustainability, and national identity across learning;
- strengthen digital literacy, AI literacy, research capability, and innovation capacity;
- cultivate 21st century skills such as communication, collaboration, creativity, critical thinking, leadership, resilience, and self-direction;
- prepare students for advanced pathways, university readiness, and future careers, particularly in STEM-related fields;
- ensure alignment with the QSTSS Learner Profile and the broader educational aspirations of the school.

In this sense, the curriculum architecture is both academic and developmental. It exists not only to organize content, but also to shape the intellectual, practical, ethical, and personal development of every learner.

6.2 Key Features of the QSTSS Curriculum Architecture

The QSTSS curriculum architecture is characterized by a number of defining features that distinguish it as a high-quality specialized STEM curriculum.

First, it combines **disciplinary depth with interdisciplinary integration**. Students build secure foundations in subject knowledge while also learning to connect ideas, methods, and skills across disciplines.

Second, it gives strong importance to **practical, experimental, and hands-on learning**. Students learn through investigation, laboratory work, design challenges, prototyping, projects, and applied problem-solving.

Third, it is deliberately **future-focused**. It incorporates digital literacy, AI-related understanding, sustainability, innovation, and university readiness as important dimensions of learning.

Fourth, it is **values-driven**. Ethical reasoning, responsibility, integrity, compassion, national identity, and global awareness are embedded across the curriculum.

Fifth, it is **developmental and progressive**. The structure of the curriculum ensures that students move from foundational STEM understanding in the earlier grades toward greater specialization, advanced study, and university preparation in the later grades.

Sixth, it is **contextualized and relevant**. Learning is connected to real-world issues, local and global challenges, community needs, scientific advancement, and future professions.

These features ensure that the curriculum is not merely academically strong, but also meaningful, coherent, and responsive to the needs of learners and society.

6.3 Foundational Curriculum Design Principles

The curriculum architecture and content are shaped by QSTSS's curriculum design principles, which guide curriculum planning, teaching, learning, assessment, and review.

6.3.1 Inquiry, Discovery, Design, and Communication

The curriculum promotes a culture in which students are encouraged to question, investigate, explore, design, test, explain, and communicate. Learning is structured to move beyond passive reception of information toward active meaning-making. Students are expected to engage with content through inquiry, experimentation, reasoning, reflection, discussion, and evidence-based communication.

6.3.2 Real-World, Project-Based, and Transdisciplinary Learning

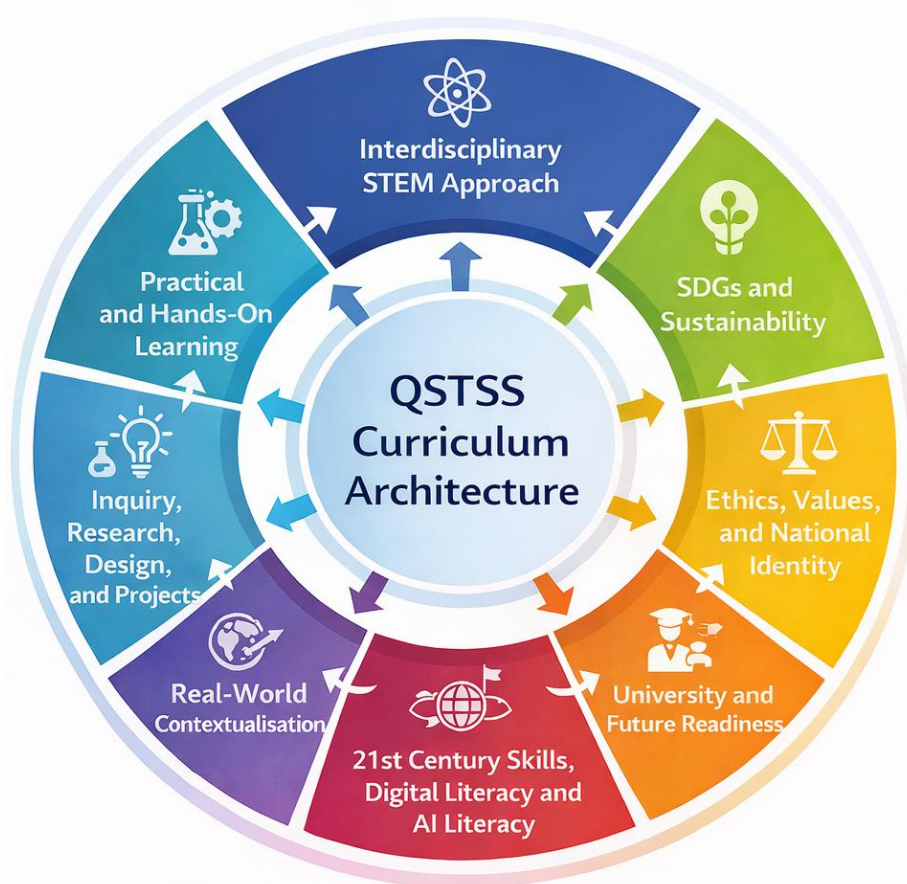
The curriculum connects learning to authentic contexts and meaningful applications. Students are given opportunities to explore real scientific, environmental, technological, social, and human challenges through project-based and transdisciplinary experiences. In doing so, they learn to transfer knowledge across contexts and to see that complex problems rarely belong to one subject alone.

6.3.3 Collaboration and Community Engagement

The curriculum is designed to support teamwork, shared inquiry, peer critique, joint problem-solving, and communication with different audiences. It also values connections with the wider community, including outreach activities, partnerships, and authentic contexts that help students link their learning with social contribution and public relevance.

6.3.4 Ethical, Sustainable, and AI-Enabled Innovation

Innovation within the QSTSS curriculum is not understood as novelty alone, but as thoughtful, responsible, and purposeful improvement. Students are encouraged to innovate through a framework that includes ethical judgment, sustainability, responsible use of technology, and awareness of the opportunities and risks associated with artificial intelligence and other emerging tools.



6.4 The Interdisciplinary STEM Approach

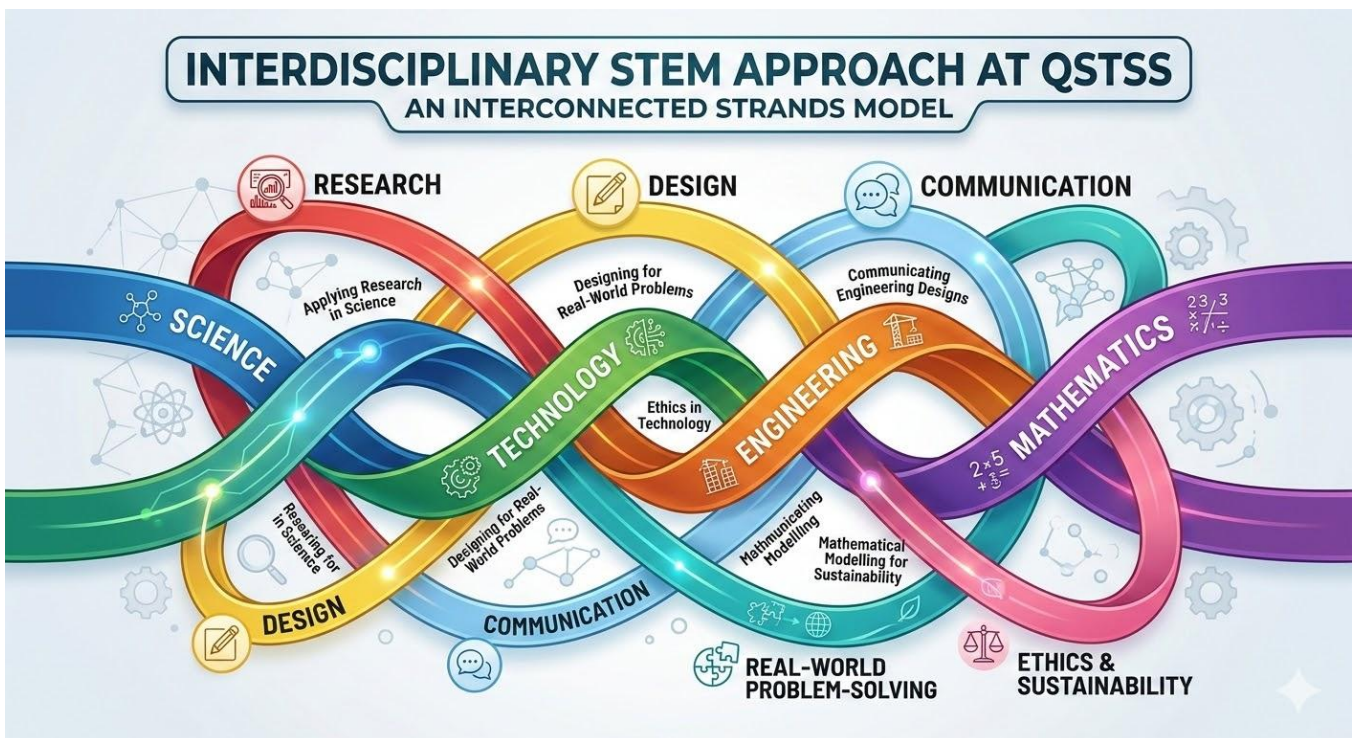
A defining feature of the QSTSS curriculum is its **interdisciplinary STEM approach**. This approach recognizes that meaningful learning, innovation, and real-world problem-solving require students to draw on concepts, tools, habits of mind, and methods from more than one discipline. For this reason, the curriculum is designed to create deliberate connections among science, technology, engineering, mathematics, language, research, design, and social understanding.

At QSTSS, interdisciplinarity is reflected in curriculum planning, teaching methodology, assessment design, project work, laboratory experiences, and applied learning tasks. Students may, for example, combine scientific investigation with mathematical analysis, engineering design with digital modelling, research with communication, or technological innovation with ethical and environmental considerations. They are encouraged to see learning as connected rather than fragmented and to understand that many of today's challenges require integrated ways of thinking.

The interdisciplinary STEM approach at QSTSS aims to help students:

- understand relationships among concepts, systems, and real-world phenomena;
- apply knowledge from multiple disciplines in a coherent and purposeful way;
- strengthen transfer of learning from one context to another;
- connect theory with application and innovation;
- develop flexible, systems-based, and solution-oriented thinking;
- appreciate the relevance of STEM to society, sustainability, and future development.

This interdisciplinary orientation is essential to the identity of the school and underpins the curriculum architecture across all grade levels.



6.5 Curriculum Learning Areas and Their Integrated Contribution

The curriculum includes a broad range of learning areas, each contributing specific knowledge and skills while also supporting the broader interdisciplinary goals of the school.

6.5.1 Languages and Communication

This area develops students' ability to read critically, write effectively, speak confidently, listen actively, present ideas clearly, and engage in academic discourse. Communication is essential across the curriculum, including scientific explanation, research reporting, argumentation, collaboration, presentation of findings, and reflection.

6.5.2 Mathematics and Quantitative Reasoning

This area develops logic, abstraction, problem-solving, quantitative literacy, modelling, precision, and analytical thinking. Mathematics serves both as an academic discipline and as a cross-cutting tool that supports scientific inquiry, engineering design, computational thinking, and evidence-based decision-making.

6.5.3 Sciences

Science learning develops conceptual understanding of natural systems, scientific reasoning, experimental competence, data interpretation, and evidence-based explanation. At QSTSS, science is closely connected with laboratory work, inquiry, engineering applications, sustainability, and real-world problem-solving.

6.5.4 Technology, Computing, and Digital Fluency

This area supports students in using digital tools effectively, critically, and responsibly. It includes digital literacy, computational thinking, responsible technology use, problem-solving through digital tools, and increasing awareness of AI tools, applications, limitations, bias, ethics, and responsible use.

6.5.5 Engineering, Design, and Innovation

This area develops students' ability to identify needs, define problems, generate ideas, create prototypes, test solutions, improve designs, and communicate the rationale behind their work. It reflects the school's emphasis on design thinking, iteration, creativity, systems thinking, and purposeful innovation.

6.5.6 Humanities, Ethics, Identity, and Global Citizenship

This area strengthens cultural understanding, ethical reasoning, social awareness, national identity, historical understanding, and appreciation of the human context of scientific and technological progress. It helps ensure that students understand not only how to innovate, but also why innovation matters and how it affects individuals, communities, and societies.

6.5.7 Research, Personal Development, and Applied Learning

This area supports inquiry, academic discipline, self-management, resilience, reflection, leadership, and independent learning. It is central to the school's emphasis on research, advanced academic preparation, student agency, and personal growth.

These learning areas are not treated as isolated silos. Instead, they work together to support the development of the whole learner and to reinforce the integrated nature of the QSTSS curriculum.

6.6 Practical, Experimental, and Hands-On Learning

Practical and hands-on learning is a central pillar of the QSTSS curriculum. The school recognizes that high-quality STEM education cannot rely on theoretical knowledge alone. Students must have regular opportunities to investigate, experiment, design, make, test, observe, collect data, analyse results, refine ideas, and learn through direct experience.

For this reason, the curriculum places strong emphasis on:

- laboratory experiments and scientific investigations;
- engineering design challenges;
- model construction and prototyping;
- technical applications and simulations;
- robotics, coding, and computational problem-solving;
- practical inquiry and field-based observation where appropriate;
- data collection, measurement, analysis, and interpretation;
- exhibitions, demonstrations, and applied performance tasks.

These experiences strengthen conceptual understanding, develop technical competence, increase engagement, and foster independence and resilience. Students learn not only from success, but also from troubleshooting, iteration, revision, and reflection. Practical learning therefore helps cultivate both competence and confidence.

Hands-on learning at QSTSS is not treated as an occasional enrichment activity. It is an essential mode of learning through which students actively construct understanding and develop the practical and investigative habits expected in a specialized STEM environment.

6.7 Inquiry, Research, Design, and Project-Based Learning

Inquiry, research, design, and project-based learning are integral to the curriculum architecture. Students are expected not only to receive knowledge, but also to generate questions, investigate issues, test ideas, build solutions, analyze evidence, and communicate their findings and reflections.

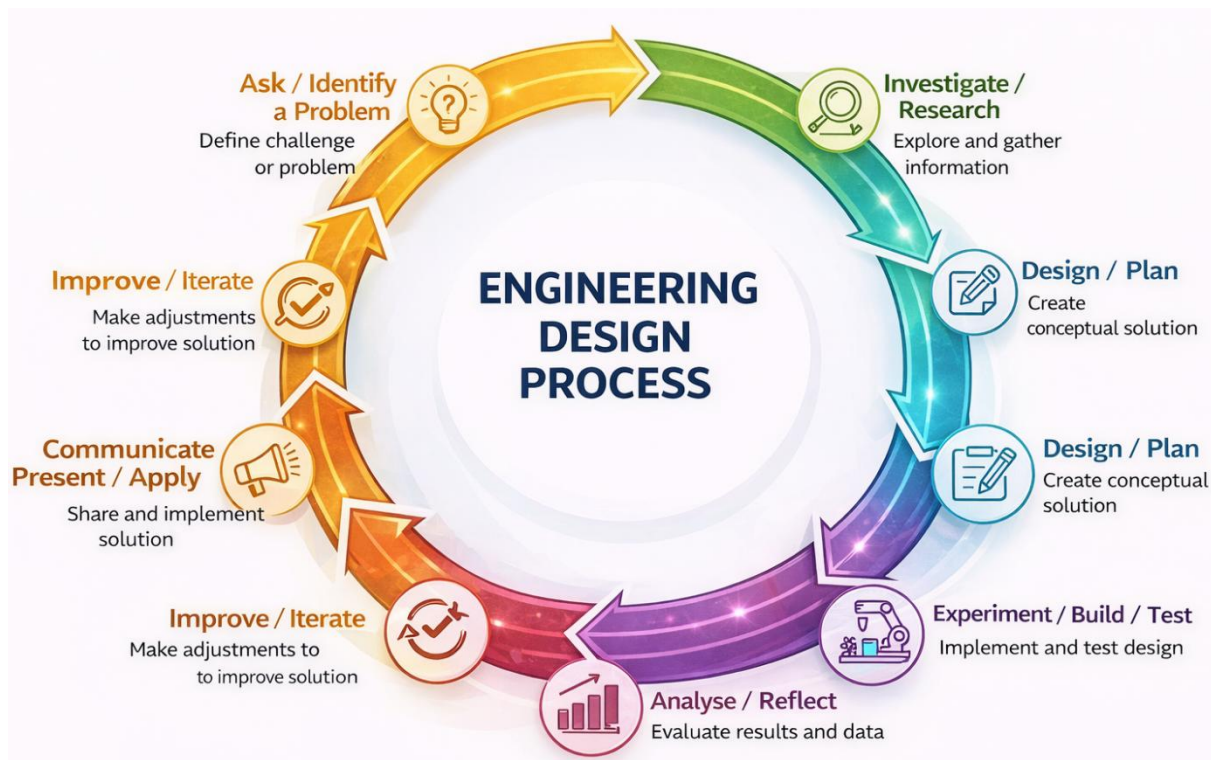
Inquiry-based learning encourages curiosity, questioning, interpretation, and evidence-based reasoning. Research-based learning develops rigor, academic discipline, source evaluation, methodological thinking, and independence. Design-based learning

enables students to move from ideas to action through cycles of empathy, ideation, prototyping, testing, feedback, and improvement. Project-based learning allows students to work over time on authentic problems that require sustained engagement, collaboration, and application of learning from multiple domains.

These approaches strengthen:

- conceptual understanding;
- critical and creative thinking;
- problem-solving and decision-making;
- communication and presentation skills;
- teamwork and leadership;
- initiative, resilience, and perseverance;
- self-management and reflection;
- the ability to transfer learning to authentic contexts.

Such learning may take place within subjects or across subjects and may include laboratory-based inquiry, research projects, interdisciplinary challenges, innovation tasks, exhibitions, and externally connected learning experiences.



6.8 Integration of the Sustainable Development Goals (SDGs)

The QSTSS curriculum deliberately integrates the Sustainable Development Goals (SDGs) as an important framework for contextualizing learning and connecting education to real global priorities. The SDGs are not treated as an isolated awareness topic. Rather, they are used as meaningful lenses through which students can examine complex issues, frame inquiry, analyze evidence, design responses, and appreciate the role of STEM in sustainable development.

Through this integration, students come to understand that science, engineering, technology, research, and innovation have direct relevance to challenges such as health, energy, climate, water, food systems, sustainable cities, responsible production, environmental stewardship, and social well-being.

The integration of the SDGs may occur through:

- inquiry units linked to environmental and social challenges;
- interdisciplinary projects focused on sustainability and innovation;
- design challenges aimed at improving systems, access, efficiency, or quality of life;
- research topics addressing local, national, regional, or global needs;
- data analysis and critical examination of development indicators and trends;
- discussions of the ethical, social, and environmental implications of scientific and technological choices;
- community engagement and awareness initiatives connected to sustainable development.

This approach makes learning more relevant and purposeful while helping students develop a sense of agency, stewardship, and responsibility toward the future.

6.9 Integration of Ethics, Values, and National Identity

The curriculum at QSTSS is grounded in ethics, values, and identity. Academic strength and innovation are not pursued separately from character, responsibility, and moral purpose. The curriculum therefore reflects Islamic values, Qatari identity, universal ethical principles, and a strong commitment to integrity, accountability, respect, empathy, compassion, and responsible action.

Ethics and values are embedded across the curriculum rather than confined to one subject. Students are encouraged to consider the ethical implications of scientific research, engineering solutions, use of data, artificial intelligence, environmental decision-making, academic honesty, collaboration, and public impact. They are also expected to demonstrate responsible conduct in inquiry, research, teamwork, communication, and use of sources.

The integration of ethics and values helps students become:

- principled and trustworthy in their academic and practical work;
- respectful of others and open to different perspectives;

- conscious of the human and societal consequences of knowledge and innovation;
- committed to integrity in research, communication, and decision-making;
- guided by care, stewardship, justice, and responsibility.

In this way, the curriculum contributes to the development of learners who combine competence with conscience and innovation with integrity.

6.10 Development of 21st Century Skills, Digital Literacy, and AI Literacy

The QSTSS curriculum is explicitly designed to develop 21st century skills and dispositions as core outcomes of learning. These competencies are not treated as optional extras or assumed by-products of academic study. They are intentionally planned for, embedded, practiced, and strengthened through teaching strategies, assessment tasks, practical work, projects, research, and collaborative learning experiences.

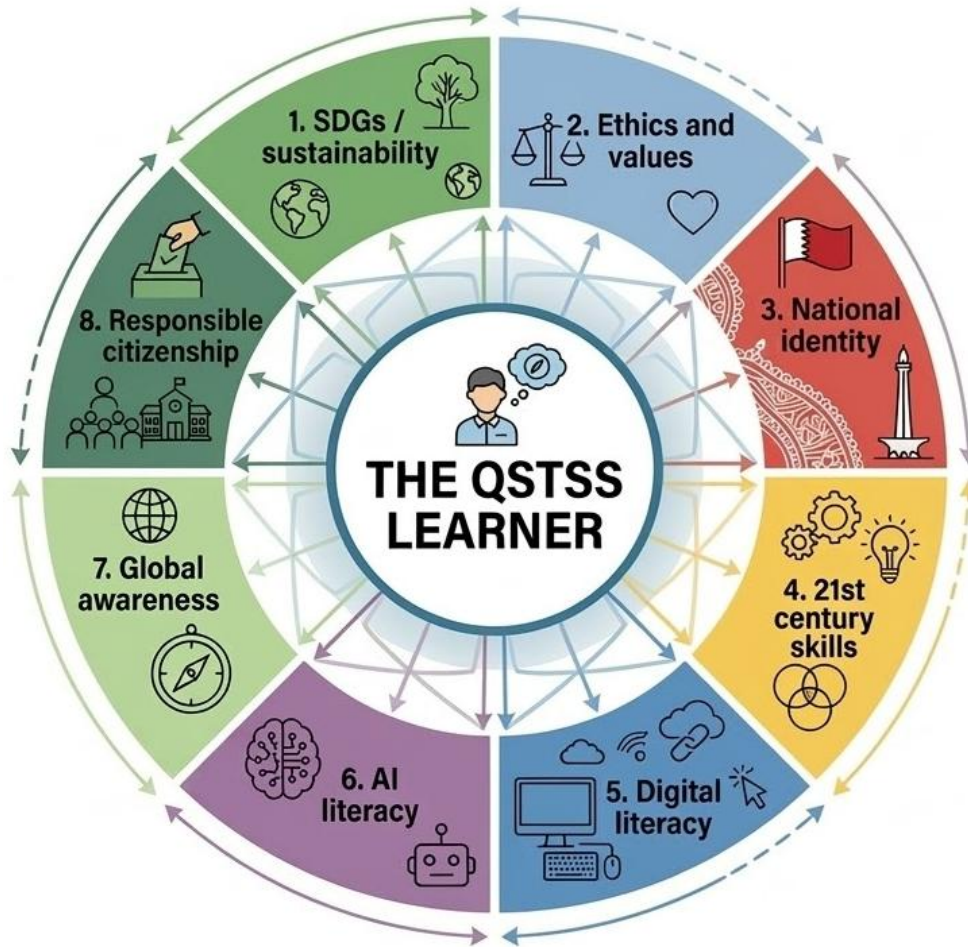
Key 21st century skills promoted across the curriculum include:

- critical thinking and analytical reasoning;
- creativity and innovation;
- communication in oral, written, visual, and digital forms;
- collaboration and teamwork;
- problem-solving and decision-making;
- self-direction and independent learning;
- adaptability, resilience, and perseverance;
- leadership and initiative;
- information literacy and media literacy;
- digital fluency and responsible technology use.

Digital literacy is embedded as a cross-cutting dimension of learning. Students are expected to use digital tools productively, critically, safely, and responsibly. They learn to locate, evaluate, manage, create, and communicate information using appropriate digital platforms and tools.

AI literacy is also increasingly important within the curriculum. Students are introduced, in age-appropriate and educationally meaningful ways, to the opportunities, limitations, ethical issues, bias concerns, and responsible uses of AI. They are expected to use AI-related tools with discernment, academic honesty, and critical awareness, rather than as passive or unquestioning users.

Together, these competencies help prepare students for university, employment, lifelong learning, and responsible participation in a world shaped by rapid technological and social change.



Cross-Cutting Dimensions of the Curriculum

6.11 Real-World Contextualization of Learning

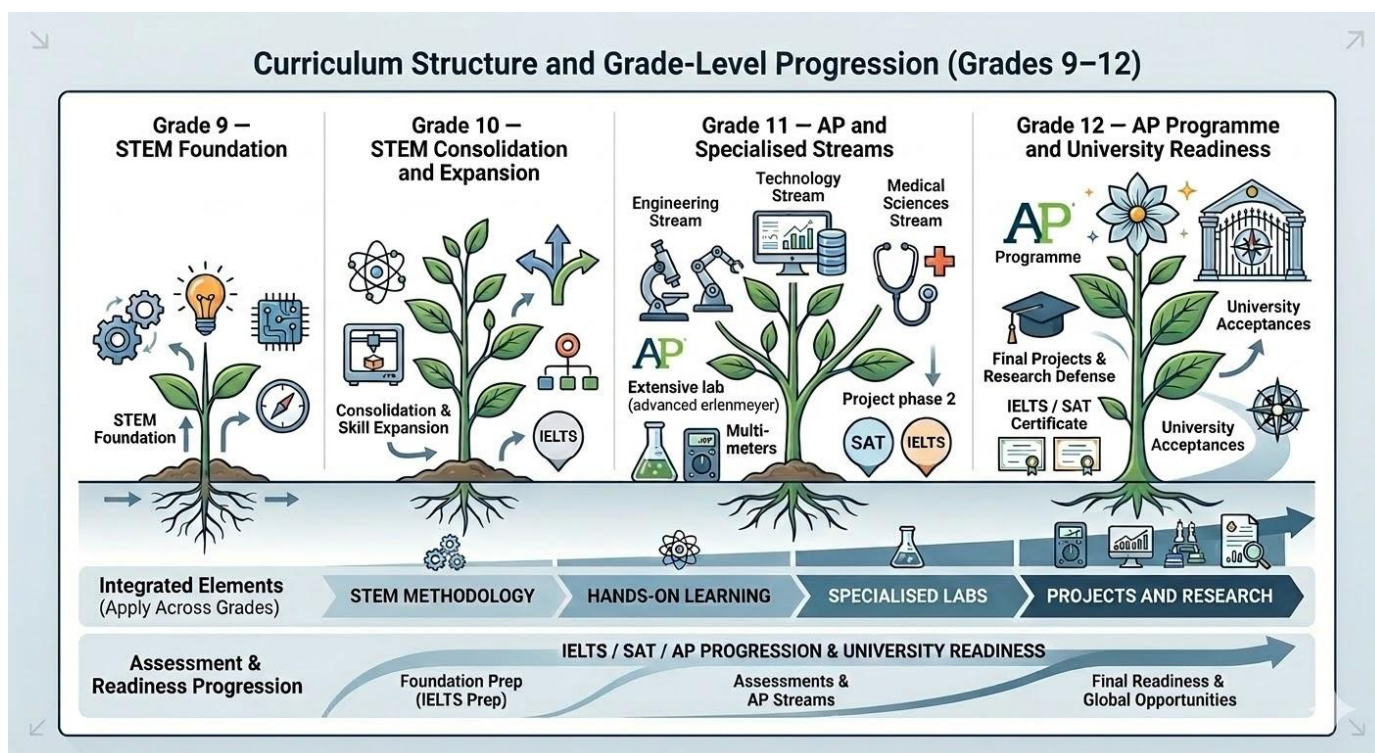
Learning at QSTSS is intentionally contextualized so that students understand the relevance and application of what they study. Curriculum content is connected to real-life situations, contemporary issues, future pathways, and the kinds of problems faced in society, science, engineering, medicine, technology, and sustainable development.

This contextualization may include local, national, regional, and global examples. It may also involve community needs, national development priorities, environmental issues, entrepreneurship, public health, innovation challenges, and future professions. By linking learning to authentic contexts, the curriculum strengthens relevance, motivation, deeper understanding, and transfer of learning.

Students therefore learn not only what concepts mean in theory, but also why they matter, how they are used, and what responsibilities come with their application.

6.12 Curriculum Structure and Grade-Level Progression

The QSTSS curriculum is structured as a progressive four-year secondary program that enables students to move from strong STEM foundations toward increasing specialization, advanced study, and university readiness. Each grade level builds deliberately on the one before it, and all stages are connected by a common commitment to STEM methodology, interdisciplinary learning, hands-on application, values-based education, and the development of future-ready competencies.



6.12.1 Grade 9: STEM Foundation

In Grade 9, the curriculum focuses on establishing a strong foundation in STEM learning and in the habits of mind required for success in a specialized science and technology school. Students are introduced to STEM methodology through interdisciplinary experiences that connect science, mathematics, technology, engineering concepts, and other academic subjects.

The Grade 9 curriculum emphasizes:

- building foundational scientific and mathematical understanding;
- introducing inquiry-based and interdisciplinary STEM learning;
- developing practical and hands-on experiences in specialized laboratories;
- engaging students in engineering design, experimentation, and project work;
- strengthening communication, collaboration, and other 21st century skills;
- helping students understand the relevance of STEM learning across subjects and real-life contexts.

This stage lays the groundwork for later progression and establishes the knowledge, skills, and dispositions needed for more advanced study.

6.12.2 Grade 10: STEM Consolidation and Expansion

In Grade 10, the curriculum builds on the Grade 9 foundation by further strengthening students' capabilities and expanding their experience of STEM methodology. Students engage with learning in greater depth and with increasing independence, while continuing to develop practical, analytical, and interdisciplinary competence.

The Grade 10 curriculum is characterized by:

- deeper engagement with STEM concepts and applications;
- expanded use of specialized laboratories and practical learning experiences;
- broader participation in project-based and research-informed learning;
- continued development of interdisciplinary thinking and problem-solving;
- academic support and enrichment that strengthen readiness for advanced pathways;
- growing exposure to university-oriented expectations and partnerships.

At this stage, students also continue to strengthen the academic and communication competencies that support progression into later specialized and pre-university pathways.

6.12.3 Grade 11: AP and Specialized Streams

In Grade 11, the curriculum moves into a more specialized phase in which STEM methodology continues to be applied within more focused academic and career-related pathways. Students increasingly engage with learning that is aligned with future university and career aspirations, particularly in fields such as engineering, medicine, science, and technology.

This stage is characterized by:

- continued implementation of STEM methodology in more specialized contexts;
- increasing academic depth and challenge in relevant subject areas;
- stronger alignment with prospective university pathways and future career interests;
- participation in preparatory programs and experiences that support higher education readiness;
- implementation of internationally recognized preparatory pathways such as IELTS, SAT, and AP, where applicable;
- greater independence in research, project work, and academic decision-making.

Grade 11 therefore represents an important transition between broad STEM schooling and advanced pre-university preparation.

6.12.4 Grade 12: AP Program and University Readiness

In Grade 12, the curriculum reaches its most advanced stage, with strong emphasis on university readiness, academic specialization, and high-level application of STEM knowledge and skills. Students are expected to demonstrate maturity, independence, academic competence, and the ability to apply learning in sophisticated and purposeful ways.

The Grade 12 curriculum includes:

- advanced application of STEM knowledge and skills;
- continued use of specialized laboratories and practical learning experiences;
- stronger emphasis on self-direction, leadership, critical thinking, collaboration, and communication;
- engagement with internationally benchmarked academic pathways, especially in science, mathematics, and computer-related subjects;
- implementation of AP courses and related advanced academic opportunities, where applicable;
- preparation for successful transition to higher education and future study pathways.

At this stage, the curriculum reflects the school's role in preparing students not only to complete secondary education successfully, but also to move confidently into university and future STEM-related pathways.

6.12.5 Coherent Progression Across Grades 9–12

Across the four grade levels, the curriculum progression at QSTSS can be understood as a movement:

- from foundation to specialization;
- from broad STEM exposure to advanced application;
- from guided learning to greater independence;
- from school-based inquiry to university and career readiness;
- from foundational practical competence to advanced laboratory, research, and analytical skills;
- from general academic preparation to internationally aligned advanced pathways.

This progression ensures that the curriculum remains coherent, developmental, and purposeful. Each grade level has a distinct role, but all stages are connected by the same underlying philosophy of STEM-infused, inquiry-driven, applied learning.

6.13 Assessment Within the Curriculum Architecture

Assessment at QSTSS is aligned with the curriculum architecture and is intended to support both learning and demonstration of learning. Because the curriculum values interdisciplinarity, practical work, inquiry, and real-world application, assessment is expected to go beyond traditional recall-based approaches.

Assessment may therefore include:

- subject-based formative and summative assessments;
- laboratory reports and experimental write-ups;
- research tasks and inquiry products;
- design challenges and engineering tasks;
- presentations, demonstrations, and exhibitions;
- interdisciplinary projects and applied performance tasks;
- reflective work and process documentation;
- authentic tasks that require analysis, synthesis, problem-solving, and communication.

Through such assessment approaches, students are able to demonstrate not only what they know, but also what they can do with what they know. Assessment therefore becomes an important tool for reinforcing the aims of the curriculum and the development of the QSTSS Learner Profile.

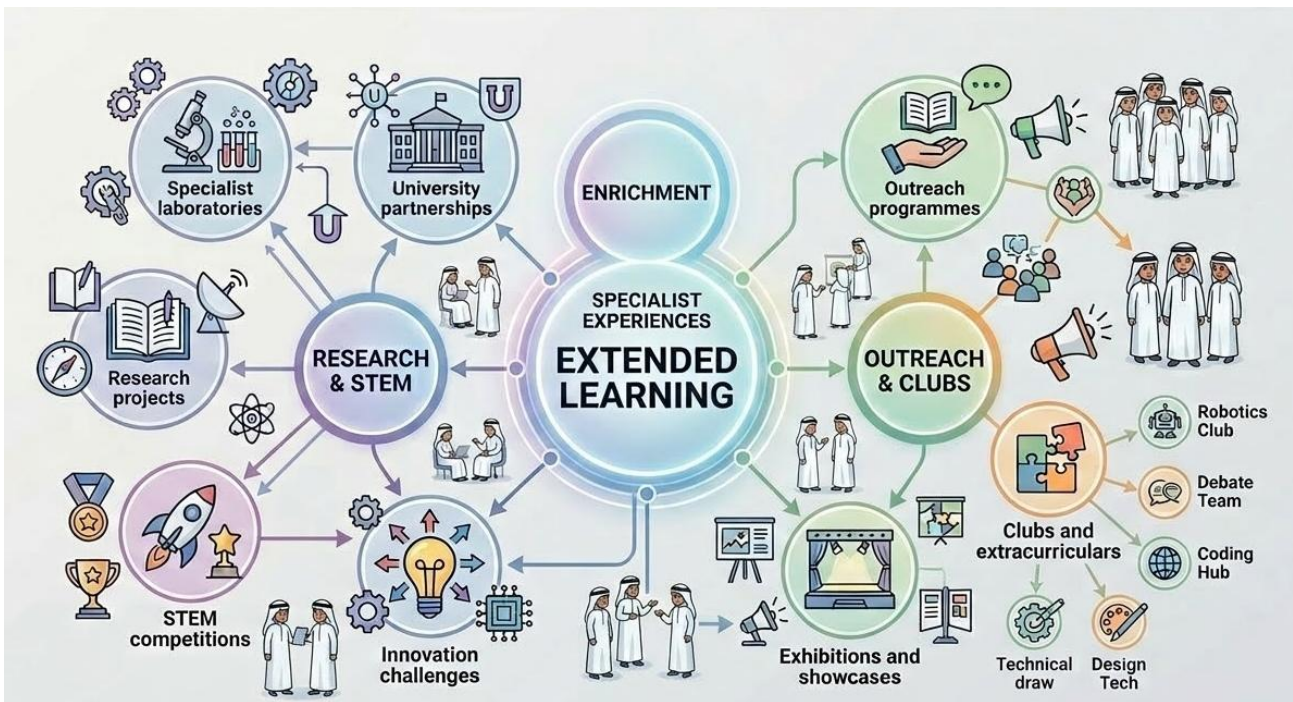
6.14 Enrichment, Specialist Experiences, and Extended Learning

The curriculum architecture at QSTSS includes experiences that extend beyond routine classroom instruction. These experiences are not peripheral; they are important components of a specialized STEM environment and help deepen engagement, support talent development, and strengthen real-world application.

Such experiences may include:

- specialist laboratories and advanced practical work;
- individual and collaborative research projects;
- innovation and design challenges;
- STEM competitions, fairs, exhibitions, and showcases;
- university-linked learning opportunities and partnerships;
- outreach programs and community-based initiatives;
- extracurricular clubs related to science, technology, coding, robotics, sustainability, design, innovation, or communication;
- advanced academic opportunities and pathways that extend student aspiration and readiness.

These experiences strengthen the bridge between classroom learning and future possibility. They also reinforce the school's identity as a place where students learn through doing, exploring, creating, presenting, and contributing.



6.15 Alignment with the QSTSS Learner Profile

The curriculum architecture and content are explicitly aligned with the QSTSS Learner Profile. Every aspect of the curriculum is intended to contribute to the development of learners who are:

- critical and creative thinkers;
- effective communicators and collaborators;
- problem solvers and decision-makers;
- inquirers and researchers;
- innovators and designers;
- STEM-literate individuals;
- digitally and AI-literate individuals;
- disciplined and responsible individuals;
- ethical and caring individuals;
- sustainable and globally aware citizens.

This alignment ensures that curriculum planning is not limited to content coverage or examination performance. Instead, it is directed toward the holistic development of learners who can think deeply, act responsibly, collaborate effectively, and contribute meaningfully.

6.16 Supporting Subject Documentation and Curriculum Review

This framework sets out the overarching architecture, philosophy, and content priorities of the QSTSS curriculum. Detailed subject-specific expectations are articulated in supporting documents such as subject curriculum guides, scope and sequence maps, unit plans, course outlines, and assessment frameworks.

This distinction is important. The curriculum framework should present the strategic and integrated picture of curriculum design, while subject-level documentation should provide the detailed content, standards alignment, learning outcomes, time allocations, and implementation guidance required for planning and delivery.

The curriculum is reviewed periodically to ensure that it remains relevant, coherent, rigorous, and aligned with:

- national requirements and Ministry expectations;
- the school’s strategic priorities and learner profile;
- developments in STEM education, digital learning, and AI;
- university and workforce expectations;
- student needs, stakeholder feedback, and implementation evidence;
- the school’s commitment to quality, innovation, and continuous improvement.

Through this process, the curriculum remains dynamic, responsive, and future-oriented.

6.17 Summary

The curriculum architecture and content at QSTSS provide a rigorous, integrated, and future-focused framework for learning. The curriculum is rooted in a strong interdisciplinary STEM approach and strengthened by practical and hands-on learning, inquiry, research, design, innovation, ethics, values, sustainability, and real-world relevance. It deliberately develops 21st century skills, digital and AI literacy, and increasing readiness for advanced study, university pathways, and future professions.

By structuring learning progressively across Grades 9 to 12, and by embedding the SDGs, ethics, values, collaboration, communication, and authentic application throughout the curriculum, QSTSS ensures that education is not limited to knowledge acquisition alone. Rather, it becomes a process of forming capable, principled, and future-ready learners who are equipped to lead, create, solve, contribute, and serve in an increasingly complex world.

This curriculum architecture is operationalised through clearly defined teaching and learning strategies, as outlined in Section 7.

Section 7: Curriculum Planning and Delivery Strategies

The QSTSS curriculum is implemented through coherent planning and high-quality teaching approaches that translate the curriculum framework into meaningful learning experiences. Curriculum planning and delivery are designed to ensure that intended learning outcomes, student experiences, and evidence of learning remain aligned with the school’s vision, learner profile, and interdisciplinary STEM identity.

At QSTSS, curriculum delivery is guided by the principle that learning should be rigorous, engaging, inquiry-driven, practical, and relevant. Teaching approaches are therefore designed to move beyond content transmission and to support deep understanding, problem-solving, collaboration, innovation, and responsible application of knowledge. The curriculum is enacted through pedagogical strategies that reflect the school’s commitment to interdisciplinary STEM learning, hands-on experiences, real-world contextualization, and the development of ethical and future-ready learners.

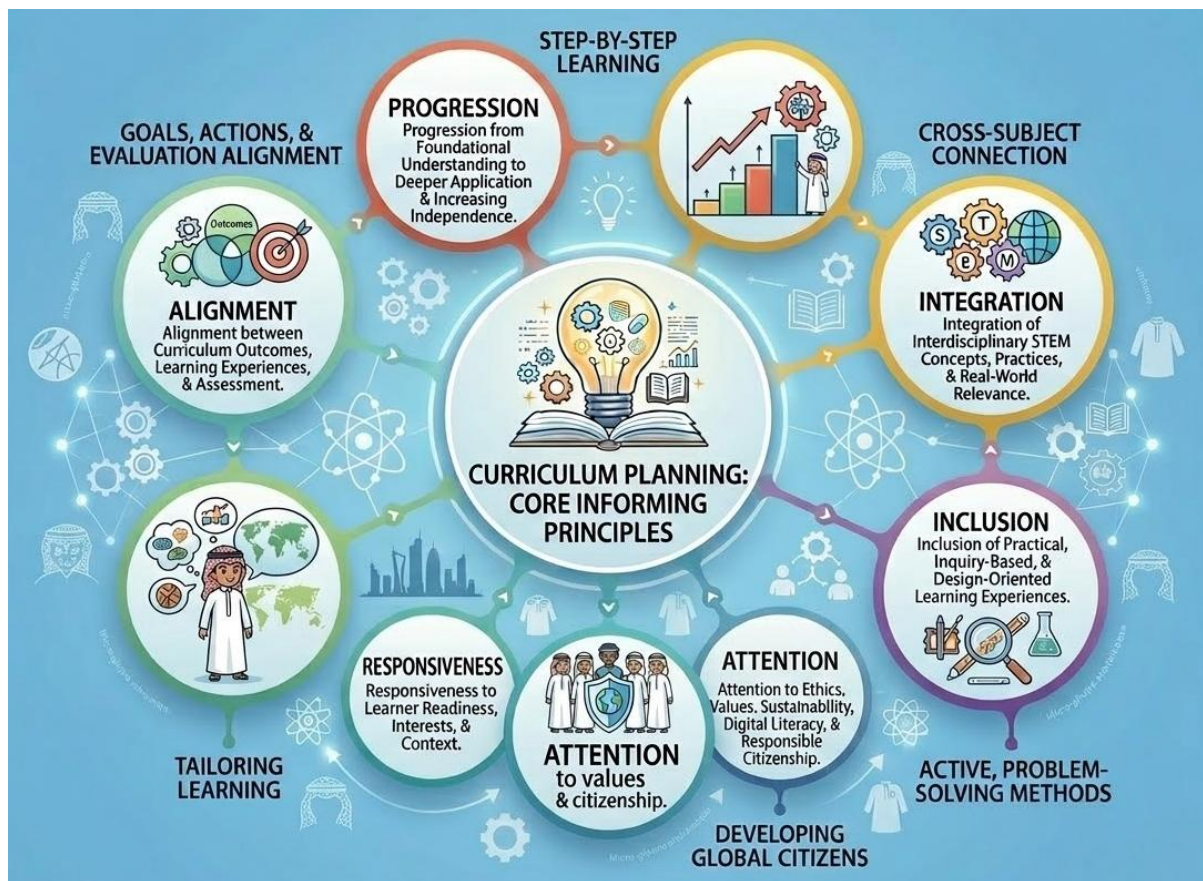
7.1 Curriculum Planning Principles

Curriculum planning at QSTSS is purposeful, aligned, and collaborative. Planning is guided by curriculum outcomes, learner needs, subject expectations, and the broader competencies the school seeks to develop. It is intended to ensure coherence across grade levels, consistency within grades, and meaningful progression in knowledge, skills, and dispositions.

Planning is informed by the following principles:

- alignment between curriculum outcomes, learning experiences, and assessment;
- progression from foundational understanding to deeper application and increasing independence;
- integration of interdisciplinary STEM concepts, practices, and real-world relevance;
- inclusion of practical, inquiry-based, and design-oriented learning experiences;
- attention to ethics, values, sustainability, digital literacy, and responsible citizenship;
- responsiveness to learner readiness, interests, and context.

Curriculum planning also reflects both vertical and horizontal alignment. Vertical alignment supports continuity and progression across Grades 9–12, while horizontal alignment supports coherence across subjects and shared learning priorities within each grade level.



7.2 Pedagogical Approach to Curriculum Delivery

The delivery of the curriculum at QSTSS is student-centered and grounded in active learning. Students are expected to engage with knowledge through investigation, experimentation, discussion, reflection, design, and application. Teaching approaches are selected not only to support content mastery, but also to develop the broader competencies embedded in the QSTSS Learner Profile.

A central feature of curriculum delivery is the use of **inquiry-based learning**, in which students are encouraged to question, investigate, analyze evidence, and construct understanding. This is complemented by **project-based and problem-based learning**, which allows students to address meaningful challenges, apply knowledge across disciplines, and develop solutions in authentic contexts.

The curriculum is also delivered through **practical and hands-on experiences**, particularly in STEM-related learning. Laboratory investigations, design challenges, modelling, prototyping, experimentation, research, and applied tasks are used to strengthen conceptual understanding and practical competence. Such approaches reflect the school's view that meaningful STEM learning requires students to learn by doing, testing, creating, and improving.

The **interdisciplinary STEM approach** is embedded in delivery strategies across the curriculum. Students are given opportunities to connect science, technology, engineering, and mathematics with research, communication, ethics, sustainability,

and real-world problem-solving. This enables them to see learning as connected and purposeful rather than fragmented.

Curriculum delivery also promotes **communication and collaboration** through discussion, teamwork, peer feedback, presentation, and collective inquiry. Students are expected to express ideas clearly, listen actively, contribute to shared tasks, and communicate findings and solutions to a range of audiences.

7.3 Learning Experiences at QSTSS

Learning experiences at QSTSS are designed to be intellectually challenging, practically engaging, and relevant to the lives and futures of students. They aim to help students build strong academic foundations while also developing the ability to apply learning in new and meaningful contexts.

Accordingly, curriculum delivery at QSTSS includes:

- inquiry and investigation;
- practical experiments and laboratory work;
- engineering design and innovation tasks;
- research activities and project work;
- interdisciplinary and transdisciplinary learning experiences;
- use of digital tools and appropriate AI-enabled applications;
- discussion, presentation, and communication of findings;
- real-world and sustainability-related contexts for learning.

These experiences support the development of deeper understanding, student agency, and readiness for advanced study and future pathways.

7.4 Technology, Digital Learning, and AI-Enabled Practice

Technology is integrated into curriculum delivery as a tool for learning, research, analysis, design, communication, and innovation. Students are expected to use digital tools productively, critically, and responsibly as part of their regular learning experiences.

The curriculum also supports the appropriate integration of AI-related tools and applications in ways that strengthen learning while maintaining ethical awareness, academic integrity, and critical judgment. In this way, digital and AI-enabled practice is treated not simply as technical use, but as part of a broader commitment to responsible and future-oriented education.

7.5 Inclusive and Responsive Delivery

Curriculum delivery at QSTSS is intended to support high expectations for all learners while recognizing variation in readiness, pace, strengths, and support needs. Teaching approaches therefore include appropriate scaffolding, differentiation, and responsive strategies that help students access learning, participate meaningfully, and make progress.

This reflects the school’s commitment to a learning environment in which challenge is balanced with support and in which students are encouraged to grow in confidence, independence, and responsibility.

7.6 Curriculum Delivery as a Bridge to Future Readiness

Curriculum planning and delivery at QSTSS are closely linked to the school’s broader goal of preparing students for higher education, advanced study, innovation, and future careers. Teaching approaches therefore seek to build not only subject knowledge, but also the habits of mind, practical competence, communication skills, research capability, and ethical awareness needed for future success.

Through interdisciplinary STEM learning, practical application, research, problem-solving, digital fluency, and authentic learning experiences, curriculum delivery becomes a bridge between classroom learning and future pathways.

7.7 Relationship with Other School Policies

This section outlines the strategic curriculum-related principles that guide planning and delivery at QSTSS. Detailed expectations, procedures, instructional standards, and implementation guidelines for teaching and learning are provided in the school’s separate **Teaching and Learning Policy** and related implementation documents.

The effectiveness of these approaches is measured through a balanced and comprehensive assessment framework, as detailed in Section 8.

Section 8: Student Assessment and Evidence of Learning

Assessment at Qatar Science and Technology Secondary School for Boys (QSTSS) is an integral component of the curriculum and is designed to support and measure student learning in alignment with the school’s vision, learner profile, and interdisciplinary STEM approach. Assessment practices are intended not only to evaluate learning outcomes, but also to guide instruction, inform student progress, and promote continuous improvement.

At QSTSS, assessment is aligned with curriculum expectations and instructional approaches to ensure coherence between what is intended, what is taught, and what is learned. It reflects the school’s commitment to developing deep understanding, practical competence, critical thinking, and the ability to apply knowledge in real-world contexts.

8.1 Principles of Assessment

Assessment at QSTSS is guided by the following principles:

- **Alignment:** Assessment is directly aligned with curriculum outcomes, learning objectives, and the QSTSS Learner Profile.
- **Authenticity:** Students are assessed through meaningful tasks that reflect real-world application and interdisciplinary learning.

- **Balance:** A range of assessment types is used to capture knowledge, skills, competencies, and dispositions.
- **Continuity:** Assessment is ongoing and embedded within the learning process.
- **Feedback and Improvement:** Assessment supports learning through timely and constructive feedback.
- **Integrity and Fairness:** Assessment practices promote transparency, equity, and academic honesty.

8.2 Types of Assessment

Assessment at QSTSS includes a balanced and complementary set of approaches:

8.2.1 Diagnostic Assessment (Assessment for Readiness)

Diagnostic assessment is used at the beginning of a course, unit, or academic year to identify students' prior knowledge, skills, and learning needs. It enables teachers to:

- establish baseline understanding;
- identify strengths and gaps;
- differentiate instruction;
- plan targeted support and extension.

Diagnostic assessment plays a critical role in ensuring that teaching is responsive and appropriately challenging for all learners.

8.2.2 Formative Assessment (Assessment for Learning)

Formative assessment is embedded within daily instruction and is used to monitor progress and guide teaching and learning. It includes strategies such as:

- questioning and discussion;
- observation and feedback;
- short tasks and checks for understanding;
- peer and self-assessment.

This approach supports continuous improvement and helps students actively engage in their learning.

8.2.3 Summative Assessment (Assessment of Learning)

Summative assessment evaluates student achievement at defined points in the learning process. It includes:

- examinations;
- structured tasks;
- projects and performance-based assessments.

These assessments measure the extent to which students have achieved intended learning outcomes.

8.3 Standardized and External Assessment (MAP Growth)

QSTSS utilizes internationally recognized standardized assessment tools, including MAP Growth, to provide objective and data-driven insights into student progress over time.

MAP Growth assessment supports the curriculum by:

- measuring student achievement and growth in key academic areas;
- providing benchmarked data aligned with international standards;
- identifying individual learning needs and progression trends;
- supporting differentiated instruction and targeted intervention;
- informing curriculum planning and instructional decision-making at classroom and school levels.

The use of MAP Growth strengthens the school's commitment to evidence-based practice and continuous improvement while ensuring alignment with global benchmarks.

8.4 Performance-Based and Authentic Assessment

Given the interdisciplinary STEM nature of the QSTSS curriculum, assessment extends beyond traditional written tests to include performance-based and authentic tasks. These allow students to demonstrate their ability to apply knowledge in meaningful contexts.

Examples include:

- laboratory investigations and scientific reports;
- engineering design challenges and prototypes;
- research projects and inquiry-based tasks;
- interdisciplinary problem-solving projects;
- presentations, demonstrations, and exhibitions.

These approaches align with the school's emphasis on practical learning, innovation, and real-world application.

8.5 Assessment of 21st Century Skills and Competencies

Assessment at QSTSS reflects the importance of developing broader competencies as outlined in the QSTSS Learner Profile. Students are provided with opportunities to demonstrate:

- critical and creative thinking;
- communication and collaboration;
- problem-solving and decision-making;
- research and inquiry skills;
- innovation and design thinking;
- digital and AI literacy;
- ethical reasoning and responsible behavior.

These competencies are assessed through a combination of subject-based and interdisciplinary learning experiences.

8.6 Use of Assessment Data

Assessment data is used systematically to support learning and improvement. It informs:

- instructional planning and differentiation;
- identification of student strengths and areas for development;
- targeted intervention and enrichment;
- monitoring of student progress over time;
- evaluation of curriculum effectiveness.

Data from classroom assessments and standardized tools such as MAP Growth are used together to ensure a comprehensive understanding of student learning.

8.7 Feedback and Student Involvement

Feedback is a central component of assessment at QSTSS. Students receive regular, constructive feedback that supports improvement and reflection. They are also encouraged to:

- engage in self-assessment;
- reflect on their learning;
- set goals and monitor progress.

This promotes student ownership and the development of independent learning habits.

8.7 Academic Integrity and Responsible Use of Technology

Assessment practices promote academic integrity and responsible behavior. Students are expected to:

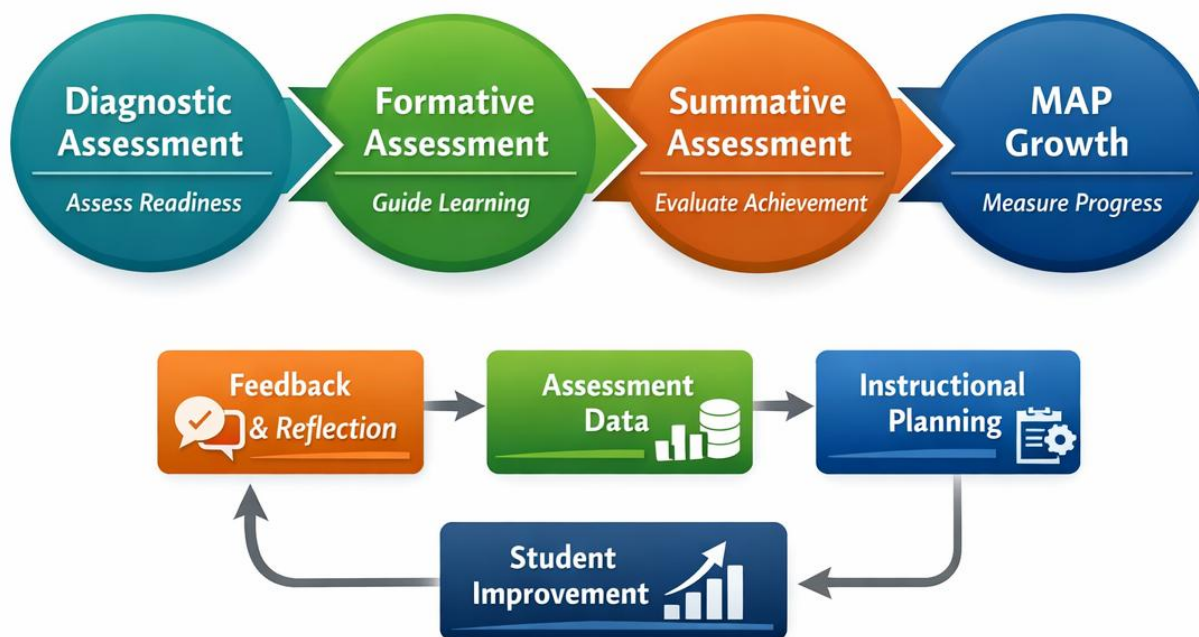
- produce original work;
- acknowledge sources appropriately;
- use digital and AI tools ethically and responsibly.

Guidance is provided to ensure that technology enhances learning while maintaining authenticity and fairness.

8.9 Relationship to Assessment Policy

This section outlines the strategic principles of assessment within the QSTSS curriculum framework. Detailed procedures, grading systems, moderation processes, and reporting structures are provided in the school's separate **Assessment Policy** and related documents.

Balanced Assessment Framework at QSTSS



Assessment outcomes inform deeper learning experiences, including laboratory-based learning, research, and innovation, as outlined in Section 9.

Section 9: Specialist Laboratories, Research, and Innovation

Specialist laboratories at Qatar Science and Technology Secondary School for Boys (QSTSS) are central to the implementation of the curriculum and represent a defining feature of the school's STEM model. These laboratories provide students with structured, high-quality environments in which theoretical knowledge is translated into practical applications, experimentation, research, and innovation.

All students have regular and sustained access to specialist laboratories, where learning is facilitated collaboratively by teachers and qualified engineers. These environments support hands-on, inquiry-based, and design-oriented learning experiences that are fully integrated within the curriculum across grade levels.

9.1 Learning Through Specialist Laboratories

Laboratory-based learning at QSTSS is designed to ensure that students:

- engage in practical experimentation and applied investigation;
- develop technical and engineering skills;
- apply scientific and mathematical concepts in real contexts;
- participate in design, prototyping, and problem-solving;
- work collaboratively under expert supervision;
- connect theoretical learning with real-world applications.

Students attend laboratories through structured timetabled sessions, project work, and supervised access linked to subject learning, interdisciplinary projects, and research activities.

In Grades 9–10, laboratories provide structured and guided learning experiences aligned with the core STEM curriculum. In Grades 11–12, laboratory experiences become more specialized, project-driven, and aligned with academic streams and advanced study pathways, including AP requirements.

9.2 Range of Specialist Laboratories

QSTSS provides a comprehensive ecosystem of specialist laboratories that support different dimensions of STEM learning, research, innovation, and skill development.

- **Digital Fabrication Laboratory**

The Digital Fabrication Laboratory enables students to engage in engineering design, product development, and manufacturing processes. Students learn to design, prototype, and create solutions using modern fabrication technologies under the guidance of specialist engineers.

In lower grades, the laboratory delivers a structured program developed in collaboration with industry partners, while in upper grades it supports engineering pathways through project-based learning and student-led innovation projects. The laboratory also contributes to the development of advanced competencies aligned with international standards, with ongoing exploration of FAB certification opportunities.

- **Energy Laboratory**

The Energy Laboratory focuses on renewable energy systems and sustainable solutions, including solar and wind energy. Students investigate energy concepts through practical experimentation and applied projects.

Learning progresses from structured activities in lower grades to advanced, project-based work in upper grades, particularly within engineering pathways. The laboratory reinforces sustainability, environmental awareness, and real-world problem-solving.

- **Robotics and Automation Laboratory**

The Robotics and Automation Laboratory develops students' understanding of robotics systems, automation, and engineering processes. Students engage in hands-on construction, programming integration, and system design.

The laboratory supports both curriculum-based learning and extended activities, including student projects and participation in competitions. It plays a key role in developing problem-solving, computational thinking, and engineering design skills.

- **Biomedicine Laboratory**

The Biomedicine Laboratory provides students with hands-on experience in life sciences, biotechnology, and human physiology. Students engage in advanced laboratory techniques such as PCR, genetic transformation, and recombinant DNA technology.

The laboratory supports the medical pathway in Grades 11–12, preparing students for further study in medicine and health sciences. It also integrates ethical considerations and real-world biomedical applications, fostering scientific inquiry and critical thinking.

- **Augmented Reality Laboratory**

The Augmented Reality Laboratory enhances conceptual understanding using interactive 3D models and immersive learning tools. Using advanced visualization technologies, students explore complex scientific concepts in an engaging and accessible manner.

- **Virtual Reality Laboratory**

The Virtual Reality Laboratory provides immersive learning experiences aligned with international standards such as NGSS. Through virtual simulations, students explore scientific and mathematical concepts in dynamic, interactive environments that complement classroom learning.

- **Computer Science Laboratory**

The Computer Science Laboratory supports programming, physical computing, and emerging technologies. Students engage in coding, machine learning, and hardware-based projects using platforms such as Arduino and Raspberry Pi.

This laboratory plays a critical role in developing digital literacy, computational thinking, and AI-related competencies.

- **Digital Library**

The Digital Library supports research, inquiry, and independent learning by providing access to a wide range of digital resources. It enhances students' ability to locate, evaluate, and use information effectively.

- **Science and STEM Laboratories**

Specialized Biology, Chemistry, and Physics laboratories provide advanced equipment, digital sensors, and data logging tools that support experimental science. These laboratories enable students to conduct investigations aligned with STEM and AP curricula, reinforcing scientific inquiry and analytical skills.

- **Language Laboratory**

The Language Laboratory supports the development of communication skills, particularly in English, through interactive digital platforms. It is also utilized to support

listening and communication skills in other subjects, including Arabic and Islamic studies.

9.3 Integration with Curriculum and Learning Pathways

Specialist laboratories are fully integrated into the curriculum and support progression across grade levels:

- **Grades 9–10:** Structured, guided laboratory experiences aligned with foundational STEM learning.
- **Grades 11–12:** Specialized, project-based, and research-oriented laboratory work aligned with academic streams and university preparation.

Laboratory learning is connected to:

- interdisciplinary STEM applications;
- project-based and inquiry-based learning;
- research and innovation activities;
- real-world problem-solving;
- sustainability and ethical considerations.

9.4 Research, Innovation, and Real-World Application

Laboratories at QSTSS serve as platforms for research and innovation, enabling students to:

- design and conduct investigations;
- develop and test prototypes;
- engage in interdisciplinary projects;
- participate in competitions and innovation challenges;
- present and showcase their work.

Students are encouraged to move beyond structured tasks toward independent inquiry and innovation, particularly in the upper grades.

9.5 Collaboration and Professional Support

A distinctive feature of QSTSS laboratories is the collaboration between **teachers and specialist engineers**, ensuring that students receive both pedagogical and technical support. Engineers also contribute to:

- curriculum implementation;
- supervision of projects and laboratory work;
- development of technical skills;
- reinforcement of subject-specific and technical vocabulary in collaboration with academic departments.

9.6 Contribution to Future Readiness

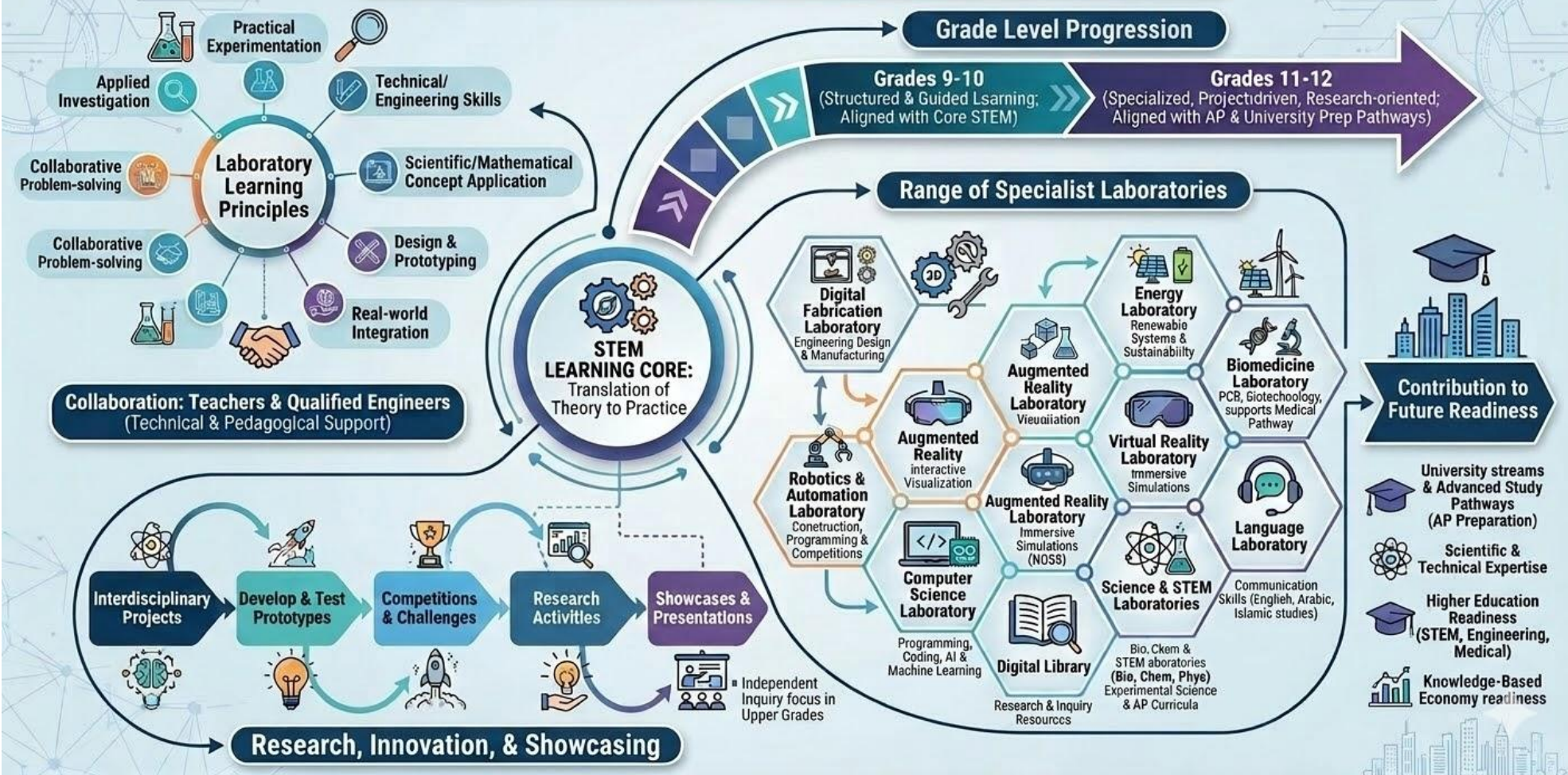
Through sustained engagement in specialist laboratories, students develop competencies essential for future success, including:

- scientific and technical expertise;
- engineering and design skills;
- research capability;
- innovation and creativity;
- collaboration and communication;
- ethical awareness and responsible practice.

These experiences prepare students for higher education, particularly in STEM, engineering, and medical fields, and support their readiness for participation in a knowledge-based economy.

These experiences are further extended through partnerships, competitions, and university pathways, as described in Section 10.

QSTSS Laboratory and Innovation Ecosystem



Section 10: Extended Learning, Partnerships, and University Readiness

At Qatar Science and Technology Secondary School for Boys (QSTSS), learning extends beyond the formal curriculum into a rich ecosystem of extended experiences, partnerships, and future-oriented pathways. These elements are integral to the curriculum and are designed to deepen learning, enhance student engagement, and prepare learners for higher education and future careers.

Extended learning at QSTSS reflects the school's commitment to providing authentic, real-world experiences that complement classroom learning and enable students to apply their knowledge, skills, and competencies in meaningful contexts.

10.1 Extended Learning Opportunities

Students at QSTSS engage in a wide range of extended learning experiences that support both academic development and personal growth. These experiences provide opportunities for exploration, application, and excellence beyond the classroom.

Extended learning opportunities include:

- STEM competitions at local, national, and international levels;
- innovation challenges and design-based projects;
- research activities and independent inquiry projects;
- student-led clubs and extracurricular programs;
- exhibitions, showcases, and presentations of student work;
- outreach and community engagement initiatives.

These opportunities foster creativity, collaboration, leadership, and resilience while reinforcing the practical and interdisciplinary nature of the curriculum.

10.2 Partnerships and External Collaboration

QSTSS actively develops partnerships with universities, industry, and community organizations to enhance learning opportunities and ensure relevance to real-world contexts. These partnerships play a critical role in enriching the curriculum and supporting student progression.

Partnerships may include:

- collaboration with universities and research institutions;
- engagement with industry experts and STEM professionals;
- joint projects and mentoring opportunities;
- access to specialized resources, facilities, and expertise;
- participation in external programs, workshops, and events.

Through these collaborations, students gain exposure to current practices in STEM fields and develop a clearer understanding of future academic and career pathways.

10.3 Research, Innovation, and Competitive Engagement

Extended learning at QSTSS strongly emphasizes research and innovation. Students are encouraged to participate in:

- research competitions and science fairs;
- engineering and robotics competitions;
- innovation and entrepreneurship programs;
- hackathons and problem-solving challenges.

These experiences provide platforms for students to apply their learning in competitive and collaborative environments, develop high-level skills, and showcase their achievements.

10.4 University Preparation and Academic Pathways

QSTSS is committed to preparing students for successful transition to higher education. The curriculum and extended learning experiences are aligned with international standards and university expectations.

University readiness is supported through:

- rigorous academic programs, including AP courses;
- development of advanced research and inquiry skills;
- preparation for international assessments such as IELTS and SAT;
- exposure to university-style learning and expectations;
- guidance on academic pathways and career options.

Students develop the academic, personal, and transferable skills required to succeed in competitive university environments, particularly in STEM and related fields.

10.5 Development of Future-Ready Graduates

Through extended learning, partnerships, and university preparation, QSTSS students develop the competencies required to thrive in a rapidly changing world. These include:

- independence and self-directed learning;
- leadership and collaboration;
- critical thinking and problem-solving;
- innovation and entrepreneurship;
- global awareness and responsible citizenship;
- readiness for higher education and future careers.

These outcomes align with the QSTSS Learner Profile and support the school's role in contributing to Qatar's knowledge-based economy.

10.6 Integration with the Curriculum Framework

Extended learning, partnerships, and university readiness are not separate from the curriculum; they are fully integrated within it. They build upon and extend:

- interdisciplinary STEM learning (Section 6);
- pedagogical approaches and delivery strategies (Section 7);
- assessment and evidence of learning (Section 8);
- laboratory-based learning, research, and innovation (Section 9).

This integration ensures coherence and maximizes the impact of all learning experiences provided at QSTSS.



The effectiveness and impact of all curriculum components are continuously evaluated and refined through systematic quality assurance processes, as outlined in Section 11.

11. Quality Assurance, Curriculum Review, and Continuous Improvement

Quality assurance and continuous improvement at Qatar Science and Technology Secondary School for Boys (QSTSS) are embedded within a coherent, structured, and evidence-based system that ensures the ongoing effectiveness, relevance, and rigor of the curriculum.

The school adopts a strategic approach in which curriculum quality is continuously monitored, evaluated, and enhanced in alignment with its vision, learner profile, and national and international expectations. This approach ensures that the curriculum remains dynamic, future-oriented, and responsive to the evolving demands of STEM education and higher education pathways.

Detailed processes, tools, and procedures for curriculum review and development are defined in the school's Curriculum Review Policy and Guidelines, which operates as the primary reference for implementation.

11.1 Strategic Approach to Quality Assurance

QSTSS maintains a whole-school quality assurance framework that ensures alignment across:

- curriculum design and architecture;
- teaching and learning practices;
- assessment and evidence of learning;
- laboratory-based learning, research, and innovation;
- extended learning and partnerships.

Quality assurance is guided by key principles, including:

- **coherence and alignment** across all components of the curriculum;
- **evidence-informed decision-making** based on multiple data sources;
- **continuous improvement** through structured review cycles;
- **accountability and shared responsibility** among leadership and staff;
- **benchmarking against national and international standards.**

11.2 Curriculum Review Framework

Curriculum review at QSTSS is implemented through a structured and cyclical process that ensures systematic evaluation and development of the curriculum.

At a strategic level, the review framework includes:

- **research and benchmarking**, ensuring alignment with STEM best practices, international curricula, and university expectations;
- **data collection and stakeholder feedback**, including input from students, teachers, parents, leadership, and external partners;
- **course and program evaluation**, examining alignment, coherence, rigor, and relevance;

- **analytical review**, including identification of strengths, gaps, and development priorities;
- **curriculum development and refinement**, ensuring continuous enhancement of curriculum design, resources, and delivery.

This structured approach ensures that the curriculum remains meaningful, coherent, articulated, and aligned with high standards, as defined in the school’s review framework .

11.3 Evidence-Informed Decision Making

QSTSS utilizes a wide range of qualitative and quantitative data to inform curriculum review and improvement. These include:

- student performance data across diagnostic, formative, summative, and standardized assessments (including MAP Growth);
- analysis of student work, research outputs, and project-based learning outcomes;
- classroom observations and instructional reviews;
- stakeholder feedback from surveys, consultations, and meetings;
- participation and performance in competitions, research, and external programs;
- benchmarking against national standards and international frameworks;
- findings from accreditation and external evaluations.

The integration of multiple data sources ensures that curriculum decisions are robust, balanced, and aligned with student learning needs and future expectations.

11.4 Monitoring and Evaluation of Curriculum Implementation

The implementation of the curriculum is systematically monitored to ensure consistency, quality, and impact. Monitoring processes include:

- review of teaching and learning practices in alignment with curriculum expectations;
- evaluation of assessment practices and alignment with learning outcomes;
- monitoring the use and impact of specialist laboratories and innovation programs;
- analysis of extended learning experiences and partnership initiatives;
- tracking student progression, achievement, and post-secondary pathways.

These processes ensure that the intended curriculum is effectively translated into high-quality learning experiences.

11.5 Continuous Improvement Cycle

QSTSS adopts a continuous improvement model that connects evaluation with action and impact. At a strategic level, this cycle includes:

1. **Evidence Collection** – gathering data from multiple internal and external sources;
2. **Analysis and Reflection** – identifying strengths, gaps, and priorities;
3. **Strategic Planning** – defining improvement actions aligned with school priorities;
4. **Implementation** – applying targeted improvements across curriculum and instruction;
5. **Evaluation of Impact** – assessing the effectiveness of implemented changes.

This cycle is embedded within the school’s planning processes and contributes directly to curriculum refinement and school improvement.

11.6 Roles and Responsibilities

Quality assurance at QSTSS is a shared responsibility supported by clear roles and structures:

- **School leadership** ensures strategic direction, alignment, and accountability;
- **Curriculum and academic leaders** oversee curriculum coherence, review processes, and implementation;
- **teachers and engineers** contribute to evaluation, innovation, and continuous improvement of learning experiences;
- **stakeholders** provide valuable feedback that informs curriculum development.

This collaborative approach strengthens ownership and ensures that improvement is both systematic and sustainable.

11.7 Alignment with Standards and Accreditation

The QSTSS curriculum is regularly reviewed to ensure alignment with:

- Ministry of Education and Higher Education (MOEHE) requirements;
- Qatar National Vision 2030 and national priorities;
- international frameworks (e.g., NGSS, AP, STEM standards);
- accreditation requirements, including STEM.org, Cognia and STEM certification standards.

The school also utilizes recognized STEM curriculum indicators to evaluate quality and guide development, ensuring that the curriculum remains globally competitive and locally relevant.

11.8 Integration with School Improvement Planning

Insights gained from curriculum review and quality assurance processes directly inform:

- the School Improvement Plan;
- the Annual Operational Plan;
- professional development priorities;
- resource allocation and program development.

This ensures that curriculum improvement is aligned with broader school priorities and contributes to sustained institutional development.

11.9 Relationship to Policies and Operational Guidelines

This section provides a strategic overview of quality assurance and continuous improvement within the curriculum framework.

Detailed processes, tools, timelines, and operational procedures are outlined in:

- the **Curriculum Review Policy and Guidelines**;
- the **Teaching and Learning Policy**;
- the **Assessment Policy**;
- accreditation and self-review documentation.

Appendix A: Expert Perspective on the QSTSS STEM Curriculum

Dr. Thomas Hsu – Lead Author, *Fundamental Science and Engineering*

Introduction

The STEM curriculum at Qatar Science and Technology Secondary School for Boys (QSTSS), particularly the Grade 9 and Grade 10 ***Fundamentals of Science and Engineering*** program, was developed under the leadership of **Dr. Thomas Hsu**, a leading expert in STEM curriculum design.

This curriculum represents a **purpose-built, integrated STEM model**, specifically tailored to meet:

- Qatar National Curriculum requirements
- NGSS (Next Generation Science Standards)
- AP course preparation
- International university admission expectations

Dr. Tom writes:

Why do we teach science and mathematics in high school education? Is the purpose to prepare 0.1% of students whom might become research scientists? Or, is the purpose to prepare 99.9% of students to succeed in an increasingly technical working world? How has technology changed teaching and learning? For better? For worse?

My purpose in this paper is to provide one answer to these complex questions and discuss the guiding principles and thinking behind the STEM curriculum for the QSTSS school. First, I would like to say what the curriculum is *not*. The *Fundamentals of Science and Engineering* curriculum is not an after- school engineering enrichment program. The first and last letters in STEM are the initials for Science and Mathematics. Qatar is leading the world with QSTSS in the synthesis of core content in science and mathematics with engaging, practical, and innovative content in technology and engineering. Why the emphasis on science and mathematics? Because, it is a pragmatic reality that our QSTSS graduates must demonstrate mastery of science and mathematics to be accepted into the next phase of their professional education. This is half of the answer to the first three questions.

To understand our choices in developing the QSTSS curriculum it is crucial to understand the goals and strategies that were defined by the Ministry of Education. Think about our challenge of preparing young people for success in a rapidly changing future world that does not yet exist. Students are diverse and their future world offers a diversity of paths to success. The QSTSS school was purpose-built to address one important success path - that of preparing students for careers in engineering, technology, medicine, and other STEM fields. The Ministry of Education wisely defined a goal that is both visionary and pragmatic.

Goal: Every graduate of QSTSS who wishes to pursue a career in STEM will be accepted by an excellent university of engineering in the United States - such as Texas A&M or

Cornell.

Strategies are large-scale, overview plans that define broadly how the goal will be met. For example, if the goal is to reduce the incidence of a disease one strategy would be to educate people on how to recognize and avoid risks, a second strategy might be to educate doctors and hospitals on recognizing the disease, and a third strategy might be to provide incentives to researchers and pharmaceutical companies to find and produce appropriate medicines. Like all good plans, The Ministry of Education plan for QSTSS specified multiple and overlapping strategies.

Strategies for QSTSS

1. Attract more and better students to STEM fields. Strategy: Include new and engaging technologies such as interactive curriculum, robotics, and virtual reality in everyday classroom use and make STEM the focus of the school in all aspects of curriculum

2. The vast majority of accepted students at the target universities have taken two or more AP courses such as AP calculus, AP physics, AP chemistry and AP biology. Strategy: *QSTSS students will take 4 AP courses in the junior and senior year.*

3. For the past decade the majority of high school graduates accepted by the target universities have been educated in accordance with the NGSS science standards which incorporate engineering processes as well as science content. Strategy: *design a new grade 9 and grade 10 STEM curriculum to meet the NGSS Science standards and simultaneously prepare students for AP courses while integrating engineering and technology consistent with the mission of the school.*

4. All students should be able to pass the Qatar national exams in science and mathematics. Strategy: *any new curriculum should be designed or selected to meet the Qatar national standards for science and mathematics.*

5. All of the entrance tests used by the target universities, such as the SAT or ACT, are in the English language. Strategy: Science and mathematics instruction at QSTSS will be in English.

6. Even students with excellent grades are often not accepted because all applicants to the target universities have excellent grades. Something additional is required to demonstrate special interest in STEM careers. Strategy: The engineering lab and technology lab facilities and faculty of the school will ensure that QSTSS students will complete multiple design projects and research projects in addition to more traditional academic work.

Designing the curriculum

The QSTSS curriculum for grades 9 and 10 had to be *primarily a science and mathematics curriculum* with technology and engineering integration wherever possible. This was necessary because:

1. the curriculum had to prepare QSTSS students for rigorous AP courses in grade 11 and 12 which were pure science or mathematics (non-STEM),
2. the curriculum had to meet the NGSS science standards, and

- the curriculum had to prepare students to scoring highly in college entrance tests such as the SAT or ACT which are not STEM.

The science topics the new curriculum had to cover were defined by the NGSS, the Qatar National Standards, and the topic areas covered by the AP courses. The mathematics topics were defined by the preparation for AP calculus, and the SAT exam. After the first iteration of the curriculum design it was decided that the integrated STEM mathematics were not sufficient for calculus/SAT preparation. The Mathematics specialists advised we add an innovative curriculum from Haese to teach a three-period-per-week math specialty class in parallel with the integrated STEM course.

While meeting the science content requirements, the QSTSS curriculum, *Fundamentals of Science and Engineering* is still not a traditional science program. Our design incorporated the concept of STEM deeply into the curriculum in five different ways. None of these five ways are part of a typical high school textbook.

STEM is a technique for teaching and learning.

There are many ways to teach any element of content. Consider the mathematics of fractions and ratios. These topics are traditionally taught with lectures and worksheets such as shown on the left below. The STEM approach uses a real engineering example - gears - to teach the same concept. Students create, analyze, and design gear machines to learn fractions and ratios by application.

Traditional lesson on fractions and ratios

Name : _____ Score : _____
 Teacher : _____ Date : _____

Converting Improper Fractions to Mixed Numbers

1) $\frac{29}{4} = \underline{\hspace{1cm}}$ 2) $\frac{13}{6} = \underline{\hspace{1cm}}$ 3) $\frac{73}{9} = \underline{\hspace{1cm}}$
 4) $\frac{65}{8} = \underline{\hspace{1cm}}$ 5) $\frac{17}{2} = \underline{\hspace{1cm}}$ 6) $\frac{5}{2} = \underline{\hspace{1cm}}$
 7) $\frac{25}{4} = \underline{\hspace{1cm}}$ 8) $\frac{43}{7} = \underline{\hspace{1cm}}$ 9) $\frac{29}{4} = \underline{\hspace{1cm}}$
 10) $\frac{73}{9} = \underline{\hspace{1cm}}$ 11) $\frac{19}{3} = \underline{\hspace{1cm}}$ 12) $\frac{43}{7} = \underline{\hspace{1cm}}$
 13) $\frac{11}{5} = \underline{\hspace{1cm}}$ 14) $\frac{91}{10} = \underline{\hspace{1cm}}$ 15) $\frac{37}{6} = \underline{\hspace{1cm}}$

Converting Mixed Numbers to Improper Fractions

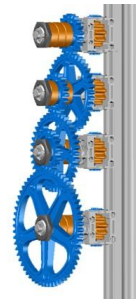
1) $7\frac{1}{3} = \underline{\hspace{1cm}}$ 2) $7\frac{9}{10} = \underline{\hspace{1cm}}$ 3) $7\frac{3}{4} = \underline{\hspace{1cm}}$

STEM lesson on fractions and ratios

One of the possible solutions.

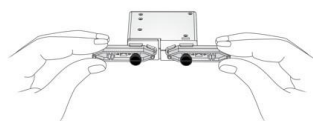
	# teeth or "s"			
Axle 1	s	s	s	20
Axle 2	s	20	s	40
Axle 3	20	40	s	s
Axle 4	60	s	s	s

$$\frac{20}{40} \times \frac{20}{40} \times \frac{20}{60} = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{3} = \frac{1}{12}$$

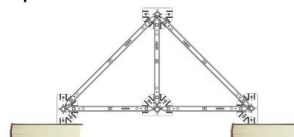


Another example is the concept of force, Force is a core idea in physics *and engineering*. Rather than take the traditional physics approach, we developed both the text and the hands-on learning activities around modern engineering tools such as a load cell (Chapter 7) and the construction of a truss bridge.

Part 1
 Measuring tension and compression with the Load Cell



Part 2
 Measuring tension and compression in truss members



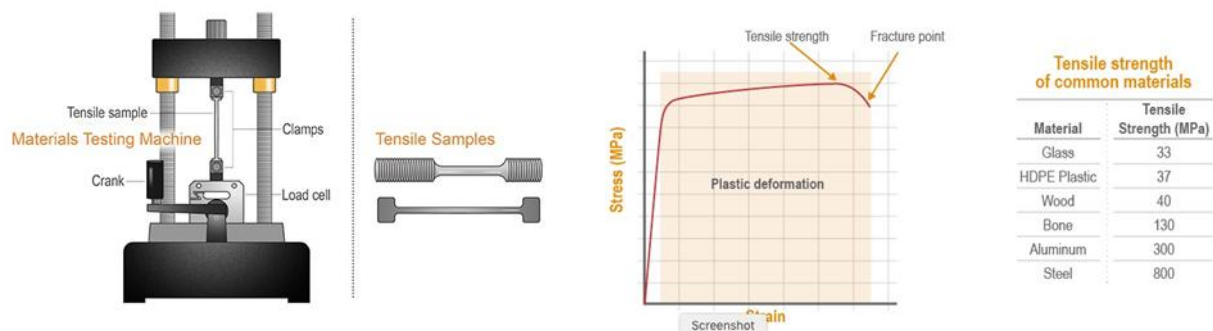
The load cell allows students to immediately experience the relationship between a force - tension or compression - and the positive or negative value that describes that force. Pushing on the load cell creates a compression or negative force. Pulling creates tension, or positive force. The human brain is a master of visual processing. Visualizing

abstract ideas is a powerful way to create real and lasting understanding, a central goal of teaching and learning.

STEM is a body of knowledge and skills broader than pure science or mathematics

In a traditional physics course, the teaching of force typically ends when students demonstrating they can solve paper and pencil equilibrium problems. In engineering the idea of force is extended to describe the strength of materials. The single force becomes the distributed stress that causes solid materials to deform and ultimately break. Students use a tensile tester (Chapter 8, grade 9) to examine the failure of materials and are introduced to some basic principles of mechanical design. Consider that solving a physics problem means finding the right answer. You typically do not care about the wrong answers. Designing a bridge to stand up cannot be done in the same way. Engineers do not design a bridge to stand up.

Engineers design a bridge not to fall down. You must consider all the ways the bridge can fail, then choose materials and design so it will not fail in any possible way. The consideration of failure is an explicit part of all engineering design. This is a STEM skill that extends pure knowledge of science into real and practical applications.



To explain the behavior of a bridge requires that many possible choices be advanced, discussed, modified, and evaluated. This is one of the important ways in which creativity is crucial to science and engineering. Creativity is much more than just creating literature, music, and art. Creativity is the source of ideas and potential explanations. Creativity is how we imagine "what if" scenarios to evaluate possible solutions.

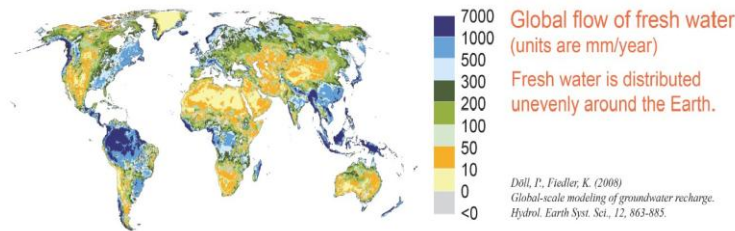
STEM provides a schema for deciding what to teach and what not to teach

Even within the topics prescribed by the standards there is far, far more scientific and mathematical knowledge than can be effectively learned in the limited amount of teaching time in a school year. Choices must be made on what to teach to be learned, what to mention briefly for completeness, and what to leave out. The Technology and Engineering aspect of STEM provides a framework in which to make these choices instead of leaving it to "how far in the book did I get by the end of the year."

1. Is this concept only useful to research scientists or is there broader application in today's engineering or technology? For example, the physics concept of electron beams in a cathode ray tube is no longer useful in technology so we did not teach this.
2. Can this concept only be read about or can the concept be explored by the student in a direct experience or through interactive simulation?

- Is there an aspect of this concept that is directly applicable to current or future engineering or technologies, and specifically to engineering and technologies relevant to Qatar?

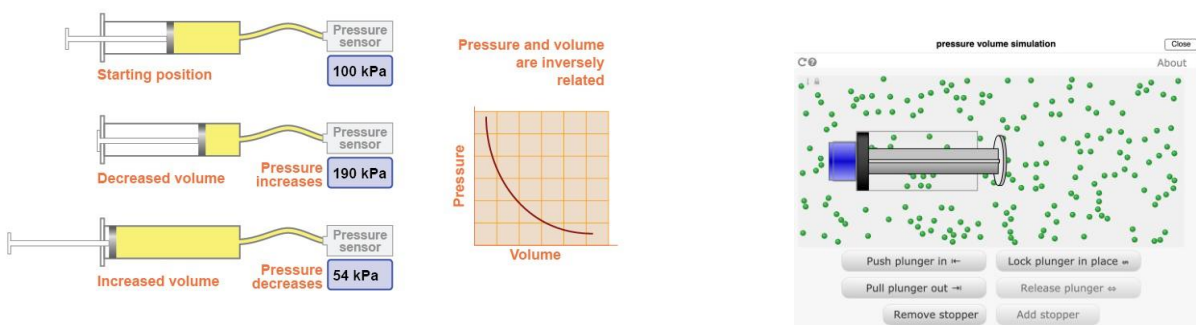
We continually asked ourselves these questions about the content of the QSTSS curriculum. As an example, when teaching the idea of biomes, we focus on the very unequal distribution of fresh water in the world. Many aspects of biomes and climate are important, but this particular aspect has critical implications for human engineering and technology (chapter 29).



STEM means using modern tools such as sensors and spreadsheets

The famous Nobel laureate Richard Feynmann was once asked if all scientific knowledge was lost except for one fact - what fact would he preserve? His answer was 'the existence of atoms'. Every aspect of our experience with the world of matter ultimately comes from the behavior of atoms. The solidity of concrete, the action of medicines, the ability of electricity to flow in wires, even the sound wave carrying my voice to you come from atoms. But atoms are invisible.

The lesson (16.4) on gas pressure in *Fundamentals of Science and Engineering* uses both a pressure sensor to measure in real-time and an interactive simulation that makes very clear how pressure is created by the motion of atoms. Students press the plunger on a syringe containing a trapped volume of air. The pressure sensor provides a real-time measurement of the pressure that the students can both feel directly and see as a numerical value.



Technology allows interactive simulation to make the atoms large and visible. Students simulate the same experiment with the syringe, but now they can see the atoms in the compressed air madly banging back against the plunger and making the force they feel.

The entirety of Chapter 4 is on the use of spreadsheets. Spreadsheets are the

	A	B	C		A	B	C
1	10	2	= A1 + B1	Typed formulas	1	10	2
2	11	3	= A2 - 3		2	11	3
3	12	4	= 2.5A3	Result	3	12	4
4	13	5	= A4/B4		4	13	5
5	14	6	= B5^2	5	14	6	
6	15	7	= (A6 + 1)/B6	6	15	7	
7	16	8	= (A7/B7) + 2	7	16	8	

indispensable mathematical tool used by virtually all scientists and engineers of all disciplines. The QSTSS curriculum teaches students to build analytical models of simple equations such as the Body Mass Index as well as more complex models.

STEM provides a contextual relevance for science content

Many practical applications use the same concept as taught in a science class but with different units of measurement. For example, the chemistry concept of concentration is typically taught with units of molarity or percent mass. In lesson 21.3, we teach the same concept with units of parts per million (ppm) or parts per billion (ppb). The solved example problem shows how pollution standards are applied to the lead content of drinking water in parts per billion.

Closing

The STEM initiative is neither the first, nor last, to help educators keep the practice of teaching aligned with useful and productive learning. To put this in perspective, consider other areas of innovation. A mechanic from a hundred years ago looking under the hood of a modern car would be clueless about most of what he found there. Yet the classrooms of most schools today look eerily similar to the classrooms of the last century. Sure, there may be digital projectors instead of chalkboards. But, most students still sit in rows listening, watching, and solving pencil-and-paper problems. Our vision for the new QSTSS textbook was different. The first and most important of our guiding ideas was that students should learn by directly experiencing science, engineering, and technology as much as possible. More than 100 interactive simulations and equations help students visualize and actively experiment with science and mathematics concepts in more effective ways than could be done with a traditional printed book. When I taught the plasma physics laboratory course at MIT in the late 1980's my students spent only 25% of time in a classroom and the other 75% in the lab doing science instead of reading about it. I am happy to see that the students and teachers at the QSTSS school are also spending most of their time in the labs.

In closing, let me repeat a few key points.

1. The current version of the QSTSS curriculum is primarily a science program that incorporates STEM content, tools and techniques to teach the science that must be covered to meet the NGSS, and prepare students for AP courses and the Qatar national exams in science.
2. The quantity of knowledge and skills our students need to succeed in the 21st century is vastly greater than it was even fifty years ago. The STEM perspective provides a scheme for prioritizing what we teach.
3. Even difficult ideas such as the molecular explanation of pressure are learnable if taught in a STEM way.
4. The requirements of 21st century learning are so much greater; the teaching tools need to be far more effective than a paper textbook and a pencil.

Dr. Tom Hsu

Appendix B: 21st Century Skills Framework at QSTSS

QSTSS integrates internationally recognized 21st-century competencies across all aspects of the curriculum.

Core Skill Domains

1. Learning and Innovation Skills

- Critical thinking
- Creativity and innovation
- Problem-solving
- Collaboration

2. Digital and Information Literacy

- Digital literacy
- Data analysis and interpretation
- Computational thinking
- AI literacy

3. Communication Skills

- Effective communication (oral & written)
- Scientific communication
- Academic writing and presentation

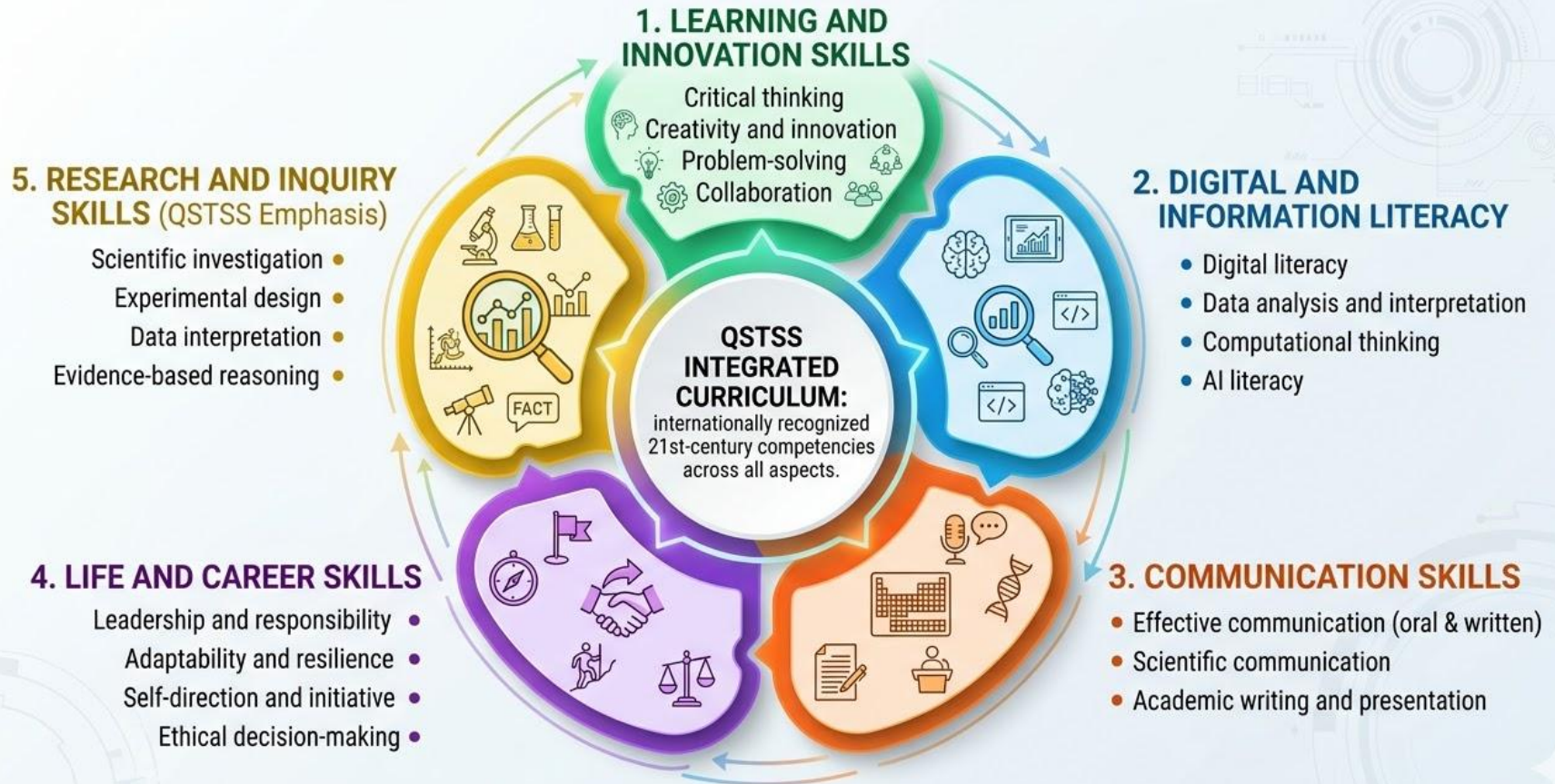
4. Life and Career Skills

- Leadership and responsibility
- Adaptability and resilience
- Self-direction and initiative
- Ethical decision-making

5. Research and Inquiry Skills (QSTSS Emphasis)

- Scientific investigation
- Experimental design
- Data interpretation
- Evidence-based reasoning

THE QSTSS 21st CENTURY COMPETENCY FRAMEWORK



Appendix C: QSTSS Core Values

The QSTSS curriculum is grounded in a strong values framework that shapes both learning and character development.

C.1 Core Values

- **Responsibility**
- **Excellence**
- **Quality**
- **Innovation**
- **Effective Communication**

C.2 Values in Practice

These values are embedded through:

- classroom practices
- project-based learning
- laboratory work
- student leadership opportunities
- community engagement

Appendix D: Alignment with the Sustainable Development Goals (SDGs)

QSTSS aligns its curriculum with the **United Nations Sustainable Development Goals (SDGs)** to promote global citizenship and sustainable thinking.



D.1 Key SDGs Integrated in the Curriculum

- SDG 3: Good Health and Well-being

- biomedical lab
- health sciences pathway

- SDG 4: Quality Education

- High-quality STEM education
- Equity and access
- lifelong learning

- SDG 7: Affordable and Clean Energy

- Energy lab projects
- renewable energy systems

- SDG 9: Industry, Innovation, and Infrastructure

- engineering design
- robotics and automation
- digital fabrication

- SDG 12: Responsible Consumption and Production

- sustainability projects
- resource efficiency

- SDG 13: Climate Action

- environmental science
- climate-related investigations

D.2 Implementation

SDGs are embedded through:

- interdisciplinary projects
- research tasks
- real-world problem-solving
- laboratory investigations

THE QSTSS STEM CURRICULUM ECOSYSTEM

