REPUBLIC OF TRINIDAD AND TOBAGO
MINISTRY OF EDUCATION

Secondary Education Modernization Programme

SECONDARY SCHOOL CURRICULUM

Forms 1–3

Technology Education

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Minister's Foreword

The Government of Trinidad and Tobago, in its *Vision 2020 Draft National Strategic Plan*, has articulated a vision of "a united, resilient, productive, innovative, and prosperous nation with a disciplined, caring, fun-loving society comprising healthy, happy and well-educated people and built on the enduring attributes of self reliance, respect, tolerance, equity and integrity" (p. 9). Five developmental pillars have been identified to achieve this goal:

   Developing Innovative People
   Nurturing a Caring Society
   Governing Effectively
   Enabling Competitive Business
   Investing in Sound Infrastructure and Environment

The Ministry of Education is one Ministry that is expected to play a pivotal role in *developing innovative people.* We therefore accept as one of our primary responsibilities, the establishment of an education system that will nurture imaginative, innovative, and eager learners. It must also facilitate the seamless progression of learners from early childhood education up to the tertiary level. Graduates of the system must emerge as creative, committed, and enterprising citizens who are prepared intellectually, and who have the will to become global leaders.

A critical contributor to this process is the national curriculum. These Curriculum Guides represent the core subjects of the national curriculum at the lower secondary level. They describe the formal content and process by which students at this level will gain the knowledge and skills that contribute to the achievement of our national goals. We expect that teachers will use these Guides to implement a school curriculum that is diversified, relevant, and of high quality, meeting the varied learning needs, interests, and abilities of all students. We expect, too, that students will be taught in ways that suit their own learning preferences. The curriculum will also connect them to their national heritage, help them to understand the issues facing their world today, and prepare them to meet the challenges and opportunities of the future.

On behalf of the entire education community, I congratulate and thank all those educators—curriculum personnel, teachers, editors, and others—who have worked together over the eight years of development and revision to produce these Curriculum Guides for secondary schools. The nation owes you a debt of gratitude. I urge you to continue to be shining lights in your communities as we move forward together to achieve our goals.

Esther Le Gendre
Honourable Minister of Education

A Note to Teachers

These Curriculum Guides have been developed by educators, including practising teachers, for teachers. They are intended to assist you to prepare students to meet the rapidly changing demands of life in the 21st century, while ensuring that they acquire the core of general knowledge and experience essential for later education and employment. The new curriculum that they represent is designed to guide the adoption of a more student-centred approach to instruction, and the provision of learning opportunities that are relevant to today's students and inclusive of varied learning needs and interests.

Since the beginning of the curriculum development process, we have seen profound changes in the use of technology in education and there is no doubt that similar shifts will take place in the coming years. The challenge for us as educators is to find ways to make our approach to teaching flexible, progressive, and responsive, so that we embrace and motivate change where it benefits learners. This entails becoming lifelong learners ourselves and creating environments that provide necessary community support and foster professional development.

The Guides embody the culmination of seven years of development and revision activity. The national curriculum will, however, be regularly reviewed to ensure that it continues to meet the needs of all students and matches the goals of society. Your input in this process is vital and we welcome and encourage your ongoing feedback.

Instructional decisions must be based on sound, contemporary educational theory, practice, and research. These documents will serve as important guides for the development of instructional programmes to be implemented at the school and classroom levels. They are organized in several parts. Part 1 is common to all and provides the general philosophy and aims in which every subject is anchored. Part 2 is specific to each subject and includes specific outcomes and sample activities and strategies that may be used to achieve them. The rest of the document is designed to suit the particular needs of each subject area. All the Guides include suggested assessment strategies and recommended resources.

We in the Curriculum Planning and Development Division are confident that the new National Curriculum Guides for Forms 1–3 will contribute significantly to enhanced teaching and learning experiences in our secondary schools and, consequently, the achievement of personal learning and national educational goals.

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August 2008

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Part 1
The National Curriculum for Forms 1–3

Background

From the Ministry of Education's *Corporate Plan 2008–2012* (p. 4)

The Government of Trinidad and Tobago, in its *Vision 2020 Draft National Strategic Plan*, has articulated a vision of "a united, resilient, productive, innovative, and prosperous nation with a disciplined, caring, fun-loving society comprising healthy, happy and well-educated people and built on the enduring attributes of self reliance, respect, tolerance, equity and integrity…"

Towards the achievement of this Vision, the Government has articulated five developmental pillars:

> Developing Innovative People
> Nurturing a Caring Society
> Governing Effectively
> Enabling Competitive Business
> Investing in Sound Infrastructure and Environment

The Ministry of Education has been identified as one of the champions for *developing innovative people.* Central to the realization of this pillar is "A highly skilled, well-educated people aspiring to a local culture of excellence that is driven by equal access to learning opportunities."

In conjunction with other key ministries, the Ministry of Education has been charged with the realization of the following goals:

> The people of Trinidad and Tobago will be well known for excellence in innovation.

> Trinidad and Tobago will have a seamless, self-renewing, high-quality education system.

> A highly skilled, talented and knowledgeable workforce will stimulate innovation driven growth and development.

> The richness of our diverse culture will serve as a powerful engine to inspire innovation and creativity.

> …Nationally, the reform of the education system is driven by several local, regional and international perspectives. We are committed to a seamless, self-renewing, high-quality education system underpinned by a National Model for Education. This National Model has three (3) foci as follows:

> i. To ensure an alignment of the education system to government's strategic plan Vision 2020 which mandates that the education system produces caring and innovative citizens

ii. To ensure that the education system produces citizens with a sense of democracy, respect for the rights of others and elders and with the ability to contribute meaningfully to the social and economic development of the country

iii. To build a strong sense of nationalism and patriotism in our citizens. (p. 7)

The Secondary Curriculum

In its commitment to comprehensive reform and expansion of the secondary school system, the Government of the Republic of Trinidad and Tobago, in 1996, adopted the report of the National Task Force on Education as educational policy. The specific recommendations for the improvement of secondary education led to discussions with the Inter-American Development Bank (IDB) for loan funding arrangements for a programme, the Secondary Education Modernization Programme (SEMP), to modernize secondary education in Trinidad and Tobago. One of the intended outcomes of this programme was improved educational equity and quality.

The curriculum guides for Forms 1–3 in eight subject areas are among the products of the programme and contribute to this outcome.

The Curriculum Design and Development Process

In order to achieve the outcomes defined by the underpinning philosophy and goals, the Curriculum Development Division of the Ministry of Education embarked on a design and development programme consonant with accepted approaches to curriculum change and innovation.

Curriculum Design

This curriculum displays a learner-centred design. Its philosophical assumptions are mainly constructivist. Its major orientation is to curriculum as self-actualization. The curriculum is student-centred and growth oriented. It seeks to provide personally satisfying experiences for each student. As the student moves from one level to another, activities also expand to allow new insights and approaches to dealing with and integrating new knowledge.

Curriculum Development

The first stage of the curriculum development process consisted of consultations with stakeholders from a cross-section of the national community. Consultations were held with primary and secondary school teachers; principals; members of denominational school boards; members of the business community; the executive of the Trinidad and Tobago Unified Teachers' Association (TTUTA); representatives from The University of the West Indies (UWI), John S. Donaldson Technical Institute, San Fernando Technical Institute, Valsayn Teachers' College, and Caribbean Union College; parents; librarians; guidance counsellors; students; curriculum officers; and school supervisors. These consultations focussed on the philosophy, goals, and learning outcomes of education.

The result of these consultations was agreement on:

- the concept of a "core," that is, essential learning outcomes consisting of skills, knowledge, attitudes, and values that students must acquire at the end of five years of secondary schooling;

- the eight subjects to form the core;

- the desirable outcomes of secondary school education in Trinidad and Tobago.

In Stage 2 of the process, the officers of the Curriculum Development Division studied the reports of the consultations, the Education Policy Paper, the reports of the Curriculum Task Force and the Task Force for Removal of Common Entrance, as well as newspaper articles and letters to the editor on education during the preceding five years. The School Libraries Division and the Division of School Supervision assisted the Curriculum Development Division in this task. The result of the study was the identification and articulation of a set of desirable outcomes and essential exit competencies to be possessed

by all students on leaving school. All learning opportunities, all teaching and learning strategies, and all instructional plans are to contribute to the realization of these outcomes and competencies.

At Stage 3, 10 existing schools were identified to pilot the new curriculum. Teachers from eight subject areas were drawn from these schools to form curriculum writing teams for each subject. Teachers with specific subject or curriculum development skills from other schools were also included in the teams. The outputs of this phase included learning outcomes specific to each subject that contribute to the fulfilment of the national outcomes; subject content; and teaching, learning, and assessment strategies to support the outcomes.

The draft curriculum guides for Forms 1 and 2 were approved by Cabinet for introduction into schools on a phased basis in September 2003. The draft guides for Form 3 were completed and introduced in the following year. Introduction of the new guides was accompanied by professional development and training for principals and teachers. The Ministry also began to supply new and/or upgraded facilities for teaching and learning, and educational technology. At the same time, work began on a new assessment and certification system.

Curriculum Revision

As implementation proceeded, feedback was sought by the Curriculum Development Division through school visits, workshops, and reviews by UWI lecturers and other stakeholders. In 2007, a survey was conducted among teachers, followed by focus group meetings, in order to concretize feedback before embarking on the revision process. As in the original curriculum development exercise, revision—the final stage—was carried out by teams of practising teachers led by officers of the Curriculum Development Division.

Curriculum Underpinnings

The national curriculum has been informed by a wealth of available curriculum theories and processes.

The major forces that influence and shape the organization and content of the curriculum include:

1. Educational philosophy and understandings about the nature of knowledge

2. Society and culture

3. The learner and learning process

4. Learning theories

5. The nature and structure of subject matter to be learned

Thus, these areas represent the foundation on which the national curriculum is built. The philosophical concerns and educational goals that shaped the curriculum also formed the basis for the dialogue with stakeholders in which the Curriculum Development Division engaged, with the aim of developing a coherent, culturally focussed, and dynamically evolving curriculum.

An internal analysis of the education system, together with research conducted in international forums, has shown that the curriculum is core to the development of innovative people. This curriculum is aimed at attaining six essential learning outcomes. The six outcomes identified help to define universally accepted goals that have been developed and underscored by other educational jurisdictions and that have been agreed to be essential. The essential learning outcomes help to define standards of attainment for all secondary school students.

Education Policies That Impact on the Curriculum

There are several Ministry of Education policies that impact on the national secondary curriculum, though some are still in the process of formalization. These include the National Model for Primary and Secondary Education in Trinidad and Tobago, the ICT policy, Standards for the Operation of Schools, and Quality Standards. Copies of these documents may be obtained from the Ministry offices or the website at *www.moe.gov.tt*. Three other policies that have direct impact on the development and implementation of the curriculum are discussed in some detail below.

National Curriculum Policy

A Draft National Curriculum Policy has been approved by Cabinet for consultation with stakeholders. The Policy statements are summarized as follows:

1. The curriculum must articulate with the goals of national development and be supportive of the aspirations of individuals and their personal development. It must provide opportunities for every student to be equipped with the knowledge, skills, attitudes, values, and dispositions necessary for functioning in an interactive, interdependent society.

2. The curriculum must be so managed as to ensure the provision of a quality curriculum experience for all students at all levels of the system.

3. At every level of the system, there must be equitable provision of requisite facilities, resources, services, and organizational structures that are conducive to and supportive of effective learning and teaching and healthy development.

4. Continuous quality management must support all curriculum and related activities at every level of the system.

5. Ongoing research and professional development activities must equip education practitioners for continued effective practice.

Though the policy has not yet been formally issued, these statements are worthy of consideration at all stages of the curriculum cycle.

Inclusive Education Policy

The Ministry of Education is committed to "support the delivery of inclusive education in all schools by providing support and services to all learners, and by taking appropriate steps to make education available, accessible, acceptable and adaptable to all learners." An inclusive curriculum is acknowledged to be the most important factor in achieving inclusive education. In planning and teaching the school curriculum, teachers are therefore required to give due regard to the following principles:

- The National Curriculum Guides set out what most students should be taught at lower secondary school but teachers should teach the required knowledge and skills in ways that suit students' interests and abilities. This means exercising flexibility and drawing from curricula for earlier or later class levels to provide learning opportunities that allow students to make progress and experience success. The degrees of differentiation exercised will depend on the levels of student attainment.

- Varied approaches to teaching, learning, and assessment should be planned to allow all students to participate fully and effectively. Account should be taken of diverse cultures, beliefs, strengths, and interests that exist in any classroom and that influence the way students learn.

- Students with special needs should be given additional instructional support in negotiating the regular curriculum, not a different one. The guiding principle of equity is to supply students who need it with additional help to achieve set standards, but not to lower the standards.

- Continuous formative evaluation must be used to identify learning needs and to shape instruction, thus maximizing students' opportunities for achieving success. Assessment strategies must be appropriate to the way the curriculum is designed and delivered, as well as to each student's individual learning profile and stage of development.

- Suitable technology must be used in instruction to facilitate learning and enhance success.

ICT in the Curriculum

The following statements are taken from the Ministry of Education's ICT in Education Policy (pp. 28–29).

<div align="center">Curriculum Content and Learning Resources</div>

- Curriculum and content must increasingly maximize the use of ICT.

- ICT must be integrated into the development and delivery of the curriculum.

- ICT integration and ICT competency measures across the curriculum shall be driven through the development and delivery of an ICT-infused curriculum.

Essential Learning Outcomes

The learning outcomes which have been deemed essential are in the areas of:

- Aesthetic Expression
- Citizenship
- Communication
- Personal Development
- Problem Solving
- Technological Competence

The achievement of these essential learning outcomes by all students is the goal that every core curriculum subject must facilitate. The core curriculum subjects, their content, and the suggested teaching, learning, and assessment strategies are the means to fulfil this end.

It is expected that by the end of the third year of secondary school, students' achievement in all six areas will result in a solid foundation of knowledge, skills, and attitudes that will constitute a platform for living in the Trinidad and Tobago society and making informed choices for further secondary education.

The essential learning outcomes are described more fully below.

Aesthetic Expression

Students recognize that the arts represent an important facet of their development, and they should respond positively to its various forms. They demonstrate visual acuity and aesthetic sensibilities and sensitivities in expressing themselves through the arts.

Students, for example:

- use various art forms as a means of formulating and expressing ideas, perceptions, and feelings;

- demonstrate understanding of the contribution of the arts to daily life, cultural identity, and diversity;

- demonstrate understanding of the economic role of the arts in the global village society;

- demonstrate understanding of the ideas, perceptions, and feelings of others as expressed in various art forms;

- demonstrate understanding of the significance of cultural resources, such as museums, theatres, galleries, and other expressions of the multicultural reality of society.

Citizenship

Students situate themselves in a multicultural, multi-ethnic environment, and understand clearly the contribution they must make to social, cultural, economic, and environmental development in the local and global context.

Students, for example:

- demonstrate understanding of sustainable development and its implications for the environment locally and globally;

- demonstrate understanding of Trinidad and Tobago's political, social, and economic systems in the global context;

- demonstrate understanding of the social, political, and economic forces that have shaped the past and present, and apply those understandings to the process of planning for the future;

- examine issues of human rights and recognize and react against forms of discrimination, violence, and anti-social behaviours;

- determine the principles and actions that characterize a just, peaceful, pluralistic, and democratic society, and act accordingly;

- demonstrate understanding of their own cultural heritage and cultural identity, and that of others, as well as the contribution of our many peoples and cultures to society.

Communication

Students use their bodies, the symbols of the culture, language, tools, and various other media to demonstrate their deeper understandings of synergies inherent in the exchange of ideas and information, and thus to communicate more effectively.

Students, for example:

- explore, reflect on, and express their own ideas, learning, perceptions, and feelings;

- demonstrate understanding of facts and relationships presented through words, numbers, symbols, graphs, and charts;

- demonstrate sensitivity and empathy where necessary in communicating various kinds of emotions and information;

- present information and instructions clearly, logically, concisely, and accurately for a variety of audiences;

- interpret and evaluate data, and express their conclusions in everyday language;

- critically reflect on and interpret ideas presented through a variety of media.

Personal Development

Students "grow from inside out," continually enlarging their knowledge base, expanding their horizons, and challenging themselves in the pursuit of a healthy and productive life.

Students, for example:

- demonstrate preparedness for the transition to work and further learning;

- make appropriate decisions and take responsibility for those decisions;

- work and study purposefully, both independently and in cooperative groups;

- demonstrate an understanding of the relationship between health and lifestyle;

- discriminate among a wide variety of career opportunities;

- demonstrate coping, management, and interpersonal skills;

- display intellectual curiosity, an entrepreneurial spirit, and initiative;

- reflect critically on ethical and other issues;

- deal effectively with change and become agents for positive, effective change.

Problem Solving

Students have a range of problem-solving strategies and apply them appropriately to situations they encounter. They demonstrate critical thinking and inquiry skills with which they process information to solve a wide variety of problems.

Students, for example:

- acquire, process, and interpret information critically to make informed decisions;

- use a variety of strategies and perspectives flexibly and creatively to solve problems;

- formulate tentative ideas, and question their own assumptions and those of others;

- solve problems individually and collaboratively;

- identify, describe, formulate, and reformulate problems;

- frame and test hypotheses;

- ask questions, observe relationships, make inferences, and draw conclusions;

- identify, describe, and interpret different points of view;

- distinguish facts from opinions.

Technological Competence

Students are technologically literate, understand and use various technologies, and demonstrate an understanding of the role of technology in their lives, in society, and in the world at large.

Students, for example:

- locate, evaluate, adapt, create, and share information using a variety of sources and technologies;

- demonstrate understanding of existing and developing technologies and use them appropriately;

- demonstrate understanding of the impact of technology on society;

- demonstrate understanding of ethical issues related to the use of technology in local and global contexts.

The Core Curriculum Subjects

The core curriculum subjects are those for which every student is required to demonstrate achievement of the stated outcomes in Forms 1–3. Additional subjects that contribute to students' holistic development and further their interests and aspirations may also be offered thereafter.

A minimum time allocation is recommended for each core subject. The principal, as instructional leader of the school, will make the final decision as to time allocation, according to the needs of the students and the resources available at any given time.

The subjects and the recommended time allocations are as follows:

Subject	No. of Periods	Subject	No. of Periods
English Language Arts	6	**Mathematics**	5
Science	4	**Health and Physical Education**	2
Spanish	4	**Technology Education**	4
Social Studies	4	**Visual and Performing Arts**	4

At the end of Form 3, students will be assessed for the National Certificate of Secondary Education (NCSE), Level I.

Language Across the Curriculum

The development of language skills and the ability to understand and use language correctly, competently, and effectively is fundamental to the learning outcomes expressed in the national curriculum. Language is a uniquely human capacity. Three simultaneous uses of language for learning are envisaged as students experience the national curriculum: students will learn language, they will learn through language, and they will learn about language.

Language plays a major role in learning, which occurs when students use the major modes of language—listening, speaking, reading, and writing—to achieve various purposes, among them: to communicate with others; to express personal beliefs, feelings, ideas, and so on; for cognitive development in various subjects of the curriculum; and to explore and gain insight into and understanding of literature. Language is linked to the thinking process, and its use allows students to reflect on and clarify their own thought processes and, thus, their own learning.

The national curriculum is predicated on the assumption that since students' language development takes place across the curriculum, the development process must be addressed in all subject areas. Students will develop and use patterns of language vital to understanding and expression in the different subjects that make up the curriculum.

However, the student of Trinidad and Tobago functions in a bidialectal context, that is, the natural language of the student, the Creole, differs from the target language and language of instruction, Internationally Accepted English. The philosophical position taken in the national curriculum is that both languages are of equal value and worth, and both must be respected. Students use their own language as a tool for interpreting the content of the curriculum and for mastering it. In addition, they must be taught to use the target language as effectively and effortlessly as they would their natural language.

The exponential growth in information and the use of information and communication technologies provide opportunities for students to become critical users of information. Language development and use in this context is also addressed in all subject areas.

Curriculum Implementation

Implementation of the curriculum is a dynamic process, requiring collaboration of the developers (curriculum teams) and users (teachers). In implementation, teachers are expected to use the formal curriculum, as described in the curriculum guides, to plan work and teach in a manner that accomplishes the objectives described. Teachers translate those objectives into units of study, determining the appropriate sequence and time allocation according to the learning needs of their students. The new Curriculum Guides provide sample teaching and assessment strategies, but it is also the role of the professional teacher to select and use sound teaching practices, continually assessing student learning, and systematically providing feedback to curriculum teams for use in revising and improving the guides.

A curriculum development system provides support for the tasks of curriculum implementation. The system advocated by the Ministry of Education involves stakeholders, specialist curriculum officers, principals, heads of departments, and teachers, each with specific roles and responsibilities. Some of these are outlined in the table below.

System Component	Members	Role
National Curriculum Advisory Council/ Committee	Stakeholders	• Advise on curriculum policy, goals, and standards
Curriculum Planning and Development Division (Head Office and District-based)	curriculum officers	• Plan and develop curriculum • Provide leadership in identifying curriculum goals and determining the process for development of curriculum materials • Lead writing teams (which include teachers) • Monitor implementation • Provide teacher support • Facilitate teacher professional development for curriculum implementation • Advise on processes and materials for effective implementation and student assessment • Evaluate curriculum
School Curriculum Council	Principal/Vice Principal and Heads of Departments	• Make major decisions concerning the school curriculum, such as assigning resources • Provide guidelines for Instructional Planning Teams
Instructional Planning Teams/School Instructional Committees	Teachers	• Cooperate on tasks necessary for effective implementation, such as: yearly work plans, units of study, development of materials to individualize the curriculum, identification and development of learning materials, student assessment and evaluation

Curriculum Implementation at School Level

The "School Curriculum" refers to all the learning and other experiences that the school plans for its students. It includes the formal or written curriculum, as well as the informal curriculum, which is comprised of other developmental opportunities provided by the school, such as those offered by student clubs, societies and committees, and sporting organizations (e.g., cricket team, debating society, Guides, Cadets).

The School Curriculum Council develops a School Curriculum that must be in alignment with the National Curriculum. The School Curriculum Council usually consists of the Principal and/or Vice Principal and Heads of Department. The duties of the Council include the development of school culture, goals, vision, and curriculum in alignment with the national curriculum and culture. It also provides support for curriculum work and performs evaluation functions.

In providing support for curriculum work, the Council may, for instance:
- encourage teachers to identify challenges and try new ideas;
- develop timetables to allow for development of curriculum materials, for example, year plans, units, instructional materials;
- ensure availability of learning materials;
- provide instructional leadership;
- ensure that appropriate strategies are formulated to promote student success.

In performing evaluation functions, the Council:
- monitors the curriculum (using, for example, observation, test scores, student books, formal and informal discussions with different stakeholders);
- assesses the hidden curriculum (including discipline policies, fund allocation, physical environment);
- evaluates the school programme of studies.

The roles of instructional teams and the individual teachers are described in the following tables:

Roles of School Instructional Committees
Develop/Revise/Evaluate work programmes
Determine resource needs
Identify/Develop instructional materials
Conduct classroom action research
Integrate and align curriculum
Identify and develop appropriate assessment practices
Develop reporting instruments and procedures (student and teacher performance)
Keep records

Roles of Individual Teachers
Develop/Revise instructional programme
Individualize curriculum to suit students' needs and interests
Develop/Evaluate/Revise unit plans
Develop/Select appropriate learning materials
Select appropriate teaching strategies to facilitate student success
Integrate the curriculum as far as possible, and where appropriate
Select appropriate assessment strategies
Monitor/Assess student learning and keep records
Evaluate student performance
Evaluate classroom programmes
Conduct action research
Collaborate with colleagues

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Part 2
The Technology Education Curriculum

Introduction

Technology Education was first introduced into the curriculum in 2001 to replace three subjects, Industrial Arts, Home Economics, and Agricultural Science, at the lower secondary level. A decision has since been made to review the national curriculum, including the curriculum for Technology Education. As part of the review process, the staff of the Ministry conducted focus group meetings with stakeholders, including teachers who had implemented the curriculum during the preceding seven years. The reviewers, therefore, have had the benefit of the experiences of these teachers, as well as comments of experts from The University of the West Indies and other institutions and interested parties.

In response to stakeholders' comments and suggestions, the reviewers have discarded the previous framework, which specified what must be done in each term of the first three years of school. Some components and sub-components have been renamed, most of the activities have been revised, and the overall content has been reduced by about 50%.

In addition, course outlines have been removed, and the main content to be delivered will be found in the activities section, under the headings of **Challenge** and **Specific Learning Outcomes**. Additions include the sections on the learning theories, Constructivism, Multiple Intelligences, and Brain-Based Learning.

New teachers can use the document to stimulate their own ideas on how to deliver the Technology Education curriculum. They can also use the document to learn how to use guided discussion methods to keep students focused. Technology education concentrates on building skills in problem identification, problem definition, testing and developing alternative solutions, and presenting reports and portfolios.

Subject Philosophy

Technology Education is informed by two main philosophical streams in education: experimentalism and existentialism. These streams suggest that each individual has two critical areas of responsibility—responsibility to self and responsibility to society. The students' very real experience is of an ever-changing world of problems to be discovered and solved. As students experiment with a variety of solutions, they remain excited about learning and develop holistically. Technology Education is therefore a process curriculum aimed at developing techniques and skills, and promoting positive behavioural change, rather than a product curriculum that is attempting to achieve coverage of a circumscribed set of facts and concepts.

Vision

Technology Education for Trinidad and Tobago will help to develop students who are technologically literate, creative, and innovative, and able to use technology to communicate effectively. Students will function as competent, productive citizens, responsive to the demands of a technologically changing society.

Rationale for Teaching Technology Education

The Ministry of Education, as part of the modernization and expansion of the education system, and in recognition of the rapid changes in technology that characterize the information age, has decided to introduce Technology Education into the national secondary school curriculum in Trinidad and Tobago. Technology Education is now identified as one of the central elements in the modernized core curriculum.

The Technology Education curriculum is perhaps the most innovative element of the entire secondary education modernization initiative. Technology Education demands a tremendous shift in the way secondary education will be delivered in schools. Not only has there been a change in the way the subject itself is conceptualized, but the curriculum demands a different philosophy and approach to the process of teaching and learning.

Technology Education is not conceptualized as a combination of the discrete subjects, Industrial Arts, Home Economics, and Agricultural Science, even though elements of each survive in some form in the curriculum. It is an activity-based, student-centred curriculum, developed with the needs of a 21st century citizen in mind. The key understandings that inform the curriculum framework can be summarized briefly as being that students learn by making hypotheses, testing products of their own design, and communicating creative solutions and decisions in a variety of formats.

Success in the 21st century global village will demand skills and attitudes towards technology that must be encouraged, supported, and facilitated through various components of formal education. Technology Education is critical to this process. It is an inclusive curriculum, which will cater for students of varying abilities, aptitudes, and interests. It will help all students to develop the values and attitudes necessary to cope in the dynamic global environment, and will equip them with the foundation to advance to higher levels of education and training. This curriculum will provide all students, regardless of background, gender, or previous experience, with opportunities to learn by making decisions in safe environments that promote and encourage creative risk-taking.

Participation in such learning environments will demand collaboration, cooperation, and high levels of interpersonal skills, as well as the ability to act in ethically and morally responsible ways. Students will also learn how to communicate effectively, using a variety of media. They will understand not only how these media work, but also how they can contribute to the use, and avoid the abuse, of the power of information. Learning outcomes such as these are essential for success in the 21st century, and illustrate the immediate connections between Technology Education and the real world in which we live, work, and play.

The curriculum will empower students by helping them to develop the knowledge, skills, and understanding, as well as the attitudes, to enable them to live, learn, and work successfully in an increasingly complex and information-driven market economy and society.

Finally, Technology Education is critical for addressing many of the problems of underdevelopment of the economic and human resources of Trinidad and Tobago. The education and training of a generation of young people to embrace technology and employ information for effective, creative problem solving not only enhances their personal employability, but also increases the potential for entrepreneurial activity and the pursuit of progress within the production, communication, and information sectors of the economy. This curriculum has therefore been designed to provide all students with practical, hands-on experience in relevant areas of information and communication technologies, materials technologies, energy and the built environment, and biological technologies—pillars of a well-articulated 21st century economy.

Expected General Learning Outcomes

As a result of their exposure to the curriculum, students will:

1. acquire and demonstrate knowledge and understanding of the principles, processes, and products of technology;

2. research, identify, and evaluate information to solve problems related to the design and construction of systems and products in technology education;

3. develop responsibility for, and understanding of, the impact and consequences of the application of technology;

4. develop sensitivity to value issues in technology, and understand its relationship to human society;

5. develop the attitudes and abilities of efficient producers and/or consumers of technological goods and services;

6. develop respect and appreciation for the fragile natural environment;

7. be mindful of the importance of the safe use of materials and the disposal of unwanted waste;

8. evaluate the products and systems in technology for functional use, economy, and efficiency;

9. develop the ability to use our indigenous resources intelligently and creatively to manufacture products that reflect our cultural diversity;

10. demonstrate respect and appreciation for fellow citizens, and communicate and share willingly the natural insights, solutions, strategies, and heuristics acquired during the period of exposure to technology education;

11. develop an awareness of, and appropriate response to, technological design and functionality;

12. develop aesthetic, creative, and artistic solutions to problems.

These general learning outcomes are directly and indirectly aligned to the essential learning outcomes (ELOs) as follows:

Essential Learning Outcomes	General Learning Outcomes
Aesthetic Expression	Items #11, 12
Citizenship	Items # 3, 4, 5, 6, 7
Communication	Items # 4, 10
Personal Development	Items # 3, 4, 5, 6,10, 11
Problem Solving	Items # 1, 2, 8,10, 11
Technological Competence	Items # 1, 2, 3, 5, 8, 9, 10

Curriculum Components and Sub-Components

This curriculum has been designed for all students in Forms 1–3 of the secondary school. It can be used by teachers from a variety of disciplines including Agriculture, Home Economics, Industrial Arts, and Information Technology. It centres on four fundamental components: Information and Communication Technologies, Materials Technologies, Energy and the Built Environment, and Biological Technologies. These four components are further subdivided into the following sub-components:

Information and Communication Technologies:

➢ Traditional and Communication Technologies
➢ New and Emerging Information and Communication Technologies
➢ Communication Skills
➢ Research Skills

Materials Technologies

➢ Traditional Materials and Processes
➢ New and Emerging Materials and Processes
➢ Food Technology
➢ Textiles Technology

Energy and the Built Environment

➢ Uses of Energy
➢ Sources of Energy
➢ Conservation of Energy
➢ Environmental Design

Biological Technologies

➢ Agricultural Technology
➢ Medical and Health Technology
➢ Environmental and Natural Resources Management Technology
➢ Biotechnology

The content elements of the curriculum are derived from the learning outcomes and activities to be undertaken under each sub-component. The components and sub-components facilitate exploration of the broadest possible set of activities, and allow students to carry out a wide range of practical applications to develop problem-solving and decision-making skills. The activities are not sequential; teachers may begin the

programme by choosing an activity from any one of the components or sub-components, or they may select or design one of their own as long as it would assist in achieving the specific learning outcomes. Consequently, the scope of the curriculum will be dependent, to a large extent, on student interest and the teacher's ability and creativity in achieving the learning outcomes.

Some of the critical content to be addressed by teachers are problem identification, the importance of safety in all activities, the use of small tools and jigs, and the importance of working cooperatively in teams. In particular, the suggested activities require students to use the techniques of problem solving to facilitate innovation and creativity.

The steps in the problem-solving method are:

1. Define the problem, that is, explain the nature of the problem or situation.
2. Investigate, research, and analyse information obtained to understand the problem.
3. Identify possible solutions.
4. Choose the solution that appears to best satisfy the need.
5. Develop/construct the solution — draw plans; design and construct the solution, incorporating resources such as people, material, information, capital tools, machines, energy, and time.
6. Utilize feedback, that is, determine the feasibility of the solution and adjust in line with suggestions.
7. Test/evaluate the solution for appropriateness.
8. Produce portfolio to provide evidence of the process in a logical or sequential format, and of the work done.

Items 1–4 are the most important phases because building or constructing without these preliminary strategies is most likely to result in ineffective solutions.

Integrating the Technology Education Curriculum

Apart from stressing problem solving, Technology Education facilitates creative thinking, decision-making skills, teamwork, and the competencies to direct and manage one's own learning. Technology Education is unique in the variety of opportunities it offers for integrating with other core subject areas. Some of the knowledge, skills, and attitudes utilized as students perform the authentic tasks that are integral to the process include the following:

Subject Area	Knowledge and Skills,	Examples
Language Arts	• Reading • Comprehension • Oral communication • Written communication • Summarizing	• Interviewing • Meeting notes • Research notes • Verbal presentations
Social Studies	• Moral, ethical, and environmental issues • Consumer skills and issues • Occupational fields • Social, cultural, and economic themes and principles • Map making	• Intellectual property • Plagiarism • Pollution • Human rights • Social responsibility
Science	• Laboratory safety • Principles of experimentation • Living organisms • Forces	• Safety rules • Safety symbols • Extraction processes • Record keeping • Characteristics and properties
Visual and Performing Arts	• Aesthetics • Use of media/presentation skills • Visual arts skills • Performing skills	• Colour combinations • Role assignment/role preparation, • Modelling • Rafting skills
Mathematics	• Numeracy skills • Measurement skills • Graphical presentations	• Flow charts, bar charts, pie charts, etc.
Physical Education	• Kinetic skills	

Part 3
Implementation of the Curriculum

Applicable Learning Theories

The changing nature of educational goals, the clear relationship between assessment and teaching and learning, and the new thrust towards documentation of students' progress in the education system drive the approach taken in designing this technology education curriculum. The educational goals of the curriculum include inculcating creative thinking skills, decision-making skills, and problem-solving skills; learning how to learn; learning how to work with others; and how to direct and manage one's own learning. The strategies suggested for delivering the curriculum are based mainly on the constructivist perspective, the brain-based learning perspective, and the multiple intelligences theory. A brief description of each of these theories follows.

Constructivism

The constructivist perspective states that learners construct knowledge for themselves, taking into account their own experiences. It follows that students are interested in real-life problems that are contextualized in their own experiences. The solutions to these problems will make use of students' prior knowledge.

The following principles of learning arise from constructivist learning theory:

1. Learning is an active process in which the learner uses sensory input to construct meaning.

2. People learn to learn as they learn; learning consists both of constructing meaning and constructing systems of meaning.

3. Constructing meaning requires use of the mind. Physical actions or hands-on experience may be necessary for learning, especially for children, but it is not sufficient; teachers should provide activities that engage the mind as well as the hands.

4. Learning involves language.

5. Learning is a social activity that takes places in connection with other persons, teachers, peers, family, and friends.

6. Learning is contextual; people learn in relationship to what they know, believe, or fear.

7. One needs knowledge to learn; it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on.

8. Learning takes time; it is not instantaneous. People need to ponder over ideas and try them out before they can be internalized.

9. Motivation is a key component in learning.

The implications for learning and teaching as a result of constructivist theory are that:

➢ teachers need to focus on the learner in thinking about learning, more than the subject or lesson to be taught;

➢ students should be allowed to work at their own pace;

➢ learning activities should be contextualized in accordance with learners' experience.

Multiple Intelligences (MI) Theory

Howard Gardner (1983) advocates that individuals are capable of deep understanding and mastery in the most profound areas of human experience. He claims that all human beings have nine intelligences, which can be nurtured and strengthened, or ignored and weakened:

1. Verbal-Linguistic Intelligence – well-developed verbal skills and sensitivity to the sounds, meanings, and rhythms of words.

2. Mathematical-Logical Intelligence – ability to think conceptually and abstractly, and capacity to discern logical or numerical patterns.

3. Musical Intelligence – ability to produce and appreciate rhythm, pitch, and timbre.

4. Visual-Spatial Intelligence – capacity to think in images and pictures, to visualize accurately and abstractly.

5. Bodily-Kinesthetic Intelligence – ability to control one's body movements and to handle objects skilfully.

6. Interpersonal Intelligence – capacity to detect and respond appropriately to the moods, motivations, and desires of others.

7. Intrapersonal Intelligence – capacity to be self-aware and in tune with inner feelings, values, beliefs, and thinking processes.

8. Naturalist Intelligence – ability to recognize and categorize plants, animals, and other objects in nature.

9. Existential Intelligence – sensitivity and capacity to tackle deep questions about human existence, such as, What is the meaning of life? Why do we die? and How did we get here?

Among the implications for learning and teaching as a result of MI theory are that:

➢ teachers teach and assess individual students differently, based on different students' individual intellectual strengths and weaknesses;

➢ teachers structure learning activities around an issue or question and connect subjects;

➢ teachers develop strategies that allow for students to demonstrate multiple ways of understanding and value their uniqueness;

➢ visual arts, music, and dance can be just as valuable to students' understanding of the world they live in as traditional academic subjects.

Brain-Based Learning Theory

Brain-based learning is based on the structure and function of the brain. Advocates of brain-based learning believe that as long as the brain is not prohibited from carrying out its normal processes, learning will occur. The core principles of brain-based learning state the following:

1. The brain is a parallel processor, that is, it can perform several activities at once, like tasting and smelling.
2. Learning engages the whole physiology.
3. The search for meaning is innate.
4. The search for meaning comes through patterning.
5. Emotions are critical to patterning.
6. The brain processes wholes and parts simultaneously.
7. Learning involves both focused attention and peripheral perception.
8. Learning involves both conscious and unconscious processes.
9. We have two types of memory: spatial and rote, the latter of which is most useful for acquiring foundational knowledge.
10. We understand best when facts are embedded in natural, spatial memory.
11. Learning is enhanced by challenge and inhibited by threat.
12. Each brain is unique.

The instructional techniques associated with brain-based learning are orchestrated immersion, relaxed alertness, and active processing. *Orchestrated immersion* refers to the creation of learning environments that fully immerse students in an educational experience. *Relaxed alertness* requires the elimination of fear in learners, while maintaining a highly challenging environment. *Active processing* allows the learner to consolidate and internalize information.

These instructional techniques have the following implications for education:

➢ Teachers must design learning around student interests and make learning contextual.

➢ Students participate in teamwork and use peripheral learning.

➢ Teachers structure learning around real problems, encouraging students to learn in settings outside the classroom as well as in the school building.

➢ Since all students are learning, their assessment should allow students to understand their own learning styles and preferences. Students can therefore monitor and enhance their own learning processes.

All of the above perspectives are learner-centred and interactive, and require a curriculum and approaches to instruction that are anchored in activities that students find meaningful and authentic. In the same way, the Technology Education curriculum takes into account the variety of learning styles, attention spans, developmental paces, and intelligences of the learner. Emphasis is on the development of competencies such as **problem solving and critical thinking,** requiring the ability to **analyse, compare, hypothesize, apply information, and innovate, that is, create solutions to meet the demands of new situations.** Learners will acquire the disposition to use these strategies and skills and will know when to apply them.

Technology Education, therefore, has great potential to eliminate the problems of boredom, restlessness, poor student attendance, and students' preoccupation with undesirable activity. A properly implemented Technology Education programme will motivate potentially great minds to aspire to good actions and constructive and productive use of their time.

Learning and Teaching Principles

The following learning and teaching principles, derived from the learning theories outlined, apply to the Technology Education curriculum:

➢ Self-directed learning through the use of project work and presentations

➢ Teacher-directed learning with strategies such as guided discussion and demonstrations

➢ Inquiry learning through the use of research projects, brainstorming, and hands-on activities

➢ Collaborative learning through group work and debates

➢ Developing metacognition – learning how to learn

➢ Contextualizing instruction in the real-life experiences of the students

➢ Designing lessons around real-life situations and encouraging students to find solutions to problems in their environment

➢ Using multiples strategies that allow students to develop their own unique understanding of identified concepts, skills, and procedures

Suggested Teaching and Learning Strategies

Technology Education demands an environment that supports dynamic interaction and creativity from both teachers and students. Teaching strategies should include periods of guided discussion to:

1. encourage students to do Internet-based research on the development of the related technologies for their projects. Such research answers the need for relevant disciplinary knowledge of chemistry, physics, biology, lasers, cloning, microprocessor technology, and the applied knowledge with respect to biotechnology, nanotechnology, mechanics, and electronics, as it is difficult for some persons to use these applications and components in a vacuum without knowing where they came from;

2. determine students' interests and encourage them to think about situations in their environment that they would like to change or improve;

3. develop students' ability to identify problems;

4. develop students' ability to apply critical thinking skills and creativity in addressing the needs of different situations.

Group work is also important for successful negotiation of this curriculum. Teachers may arrange their classes in groups of three to five students and ask each group to identify problems in their neighbourhood or home. The students could then explore the problem and work together to find solutions. The teacher should move from group to group to monitor and guide the activity as needed.

Other teaching and learning strategies may include any or all of the following.

- Developing information resource banks, for example, textbooks, DVDs, websites, Help files, handouts, brochures, catalogues, procedure sheets, bulletins, journals, newspaper articles, fact sheets

- Demonstrating practical skills required for a process or procedure

- Demonstrating research skills

- Using resource personnel, for example, community leaders, businessmen, inventors, technicians, and professionals may be invited to share their experiences with the students

- Projects

- Games

- Competitions

- Skits

- Journal-writing

- Field trips

- Interviews

Assessment and Evaluation Principles

Technology Education makes use of alternative assessment methods to determine what students know and can do. Alternative assessment, also known as Authentic or Performance assessment, requires students to generate solutions to problems, rather than to choose from predefined sets of responses. Alternative assessments focus on the learning process, the student's and the group's performance, and, ultimately, the product. They stress the importance of examining the processes as well as the products of learning. They discourage the "one right answer" mentality and challenge students to explore the possibilities inherent in open-ended, complex problems.

The following assessment and evaluation principles apply to Technology Education:

➢ Authenticity – assessments are authentic when they have meaning in themselves – when the learning they measure has value beyond the classroom and is meaningful to the learner. Authentic performance assessments:

- encourage students' self-assessment and self-reflection
- tap higher-level thinking and problem-solving skills
- use tasks that are themselves meaningful instructional activities—a new approach for teachers
- invoke real-world applications
- use human judgement for scoring
- provide opportunities for both individual and group work
- encourage students to continue the learning activity beyond the scope of the assignment

➢ Meaningfulness – students perform tasks that are real and important to them

➢ Multifaceted assessment – this requires students to accomplish complex and significant tasks

➢ Use of existing knowledge and skills and recent learning to solve problems

➢ Provision of information to all stakeholders, including students, about their progress and about ways in which students can improve their performance

➢ Students' collaboration to produce solutions to problems

➢ Mixed grouping – students of mixed ability are placed in groups of three or five

➢ Clear definition of learning outcomes to be assessed

➢ Definition of assessment activity that demonstrates outcome

➢ Articulation of criteria/standards for evaluating performance

➢ Provision of scoring rubric for each criteria

- ➢ Marking based on performance
- ➢ Clear interpretation of marks
- ➢ Keeping records of all assessment and evaluative instruments
- ➢ Utilization of results of assessments to guide instruction

Assessment and Evaluation Tools and Strategies

The following assessment and evaluation tools and strategies reflect the principles described. It is suggested, therefore, that teachers may want to choose from among these tools and strategies when planning instruction, to help them to assess the extent to which students have achieved the learning outcomes proposed in the curriculum document:

- Design portfolios
- Oral presentations
- Examination of products
- Simulations
- Checklists
- Progress interviews
- Demonstrations
- Role play
- Informal or formal observations
- Journals

The design portfolio is a major assessment tool. Each student is required to produce a design portfolio based on the specific learning outcome identified. Each portfolio should include evidence of investigation and research, pictures, rough sketches (drawings), schematic diagrams, tests of materials and processes, records of discussions, and evidence of self-evaluation and any other evaluation that had taken place during the group work, for example, peer evaluation and pre-tests.

Teachers should provide students with a design portfolio worksheet to help them work through the stages of the design process. This worksheet should contain the following elements of design:

- Statement of the problem
- Generation of initial ideas
- Development of possible solutions
- Testing of ideas and process
- Development of a plan for construction
- Construction of the solution

Each activity, across all the components of the curriculum, may be assessed based on the criteria, performance standards, and scoring rubrics described in the following table, or teachers may develop their own to suit the situation in their schools:

Criteria	Standards	Scoring Rubrics
Group Work	- cooperative spirit - team spirit - recording skills	To what extent the student: - participates willingly and constructively in the group - initiates, develops, and sustains interaction in the group - contributes ideas and builds on the ideas of others
Use of Tools and Materials	- safety practices - tool selection - manipulative skills - work habits and sense of responsibility	To what extent the student is able to: - identify common tools and their proper uses - choose materials based on their characteristics - use materials carefully to minimize waste - use safety equipment and follow safety procedures
Use of Computers	- safe use of technology - manipulative skills	To what extent the student is able to: - use correct start-up routines - demonstrate familiarity with the operating system - use the mouse and keyboard - use correct computer terminology - efficiently apply a computer graphics program to a task
Product	- product characteristics - product specifications	To what extent is the final product: - consistent with the task requirements and design parameters - aesthetically pleasing - innovative in design
Problem solving	- design and problem-solving skills	To what extent does the student demonstrate: - engagement in the problem - appropriate use of background knowledge - effective problem-solving processes - the ability to present solutions to the problem
Presentation	- content - communication skills - use of media - time management	Does the student demonstrate the ability to provide: - clear, easy-to-understand explanations - relevant background information - logically sequenced ideas

Students will be given a mark based on performance, as illustrated below.

Suggested Rating Scale

No performance/Minimal performance   0

Limited performance   1

Adequate performance   2

Competent/Proficient performance   3

Exemplary/Superior performance   4

Marks will be interpreted in relation to previously defined or agreed upon standards of performance. Scoring guidelines must be reviewed for each activity.

Resources

Technology Education activities require a wide variety of resources, including laboratory facilities, technical equipment, machinery, consumables, the Internet, magazines, and experts in the different fields as well as other resource persons. Where suggested resources are not available, teachers may modify the activities or create entirely new activities based on student suggestions. Teachers may also use the resources from the Industrial Arts laboratories where these are available. Consequently, the availability of resources, such as software, computers, and Internet connections, will determine which tasks are most appropriate. See Appendices for lists of essential resources for Technology Education.

Part 4
Curriculum Components, Sub-Components, and Activity Sheets

Information and Communication Technologies

The Information and Communication Technologies (ICT) component provides students with the opportunity to use information and communication technology tools such as computer hardware and software, calculators, fax machines, television and radio, VCRs, and other electronic devices. It also affords students the opportunity to seek, analyse, and evaluate information; solve problems; make decisions; and communicate and collaborate with others in a team.

Definition

Information and Communication Technologies (ICTs) describe a range of technologies used for gathering, storing, retrieving, processing, analysing, and communicating information. Advances in ICT have gradually reduced the costs of managing information, enabling individuals and organizations to undertake information-related tasks much more efficiently, and to introduce innovations in products, processes, and organizational structures. ICTs include tools such as more traditional technologies such as radio and the newer digital technologies like computers, lasers, infrared devices, Bluetooth, satellite, radar**,** mobile phones, and the Internet.

In this curriculum, the **Information and Communication Technologies** component is divided into four main areas:

Traditional Information and Communication Technologies: This sub-component introduces students to devices that have been used in the past, and continue to be used to a greater or lesser extent, to facilitate communication (drums, smoke signals, sign language, flags, Morse code, radio, television). Some of the technologies students will learn about in this sub-component are used only in very specialized contexts today, while others continue to be widely used.

New and Emerging Information and Communication Technologies: This sub-component introduces students to the information and communication technologies of the 21st century. Computers and the Internet, mobile technology, wireless, facsimile machines, and mobile phones are examples of new and emerging technologies in this field. Multimedia applications, videos, and audio recordings are other examples of technologies that are used today to transmit information with increased efficiency.

Communication Skills: This sub-component is intended to enhance students' ability to use the computer by developing keyboarding and word processing skills, and knowledge of spreadsheets and databases; their ability to use graphic applications to produce web pages, posters, call cards, advertisements, and reports; as well as their ability to use computer-aided design (CAD) applications to produce drawings, diagrams, pictures, and other visual images to communicate effectively.

Research Skills: This sub-component will develop students' ability to use the Internet and other sources to seek, analyse, and evaluate information, solve problems and make decisions, and communicate and collaborate with others in a team.

Content Standards

1. Describe traditional forms of Information and Communication Technologies.

2. Demonstrate a moral and ethical approach to the use of technology.

3. Describe how new and emerging technologies are used to communicate information.

4. Access and use new and emerging information and communication technologies to communicate information.

5. Identify possible sources of health risk when using communication equipment and devices.

6. Manipulate lines and basic geometric shapes to compose drawings and pictures.

7. Use communication equipment in an appropriate manner to minimize health and safety risks to persons and to avoid damage to equipment.

8. Design, develop, publish, and present products, for example, Web pages, newsletters, and reports using appropriate technologies.

9. Demonstrate a basic understanding of the operating skills required to use a variety of technologies.

10. Use keyboarding skills to compose, revise, and edit text.

11. Use word processors, spreadsheets, and databases to organize and manipulate data.

12. Integrate various software applications.

13. Navigate and create hyperlinked resources.

14. Locate information to answer research questions, using a variety of sources, such as printed texts, bulletin boards, biographies, art, music, community resource persons, CD-ROMs, and the Internet.

15. Critically assess information obtained through the use of a variety of technologies.

List of Activities

Sub-Components	Activities
Traditional Information and Communication Technologies	From Drums to Television Introduction to Visual Communication
New and Emerging Information and Communication Technologies	Digital Communication Devices Audiovisual Presentations Video Production Desktop Publishing
Communication Skills	Introduction to Computers File Management Word Processing Computer-Aided Design
Research Skills	Research New Technologies Research and Create a Report on the Internet

Each suggested activity is divided into several parts as follows:

➤ The Content Standard
➤ The Context
➤ Challenge
➤ The Specific Learning Outcomes
➤ Suggested Resources

Content Standard: The content standard provides information on the knowledge students should have in order to achieve the specific learning outcomes.

Context: The context provides important information to help students understand the nature of the problem to be solved or the conditions underlying the task. It also provides an overview of the general purpose for the task and the subject setting.

Challenge: The challenge may be a question or may involve a single-step process that can be completed in one session. However, it may also be complex and may take several lessons to complete. Also, the task may involve several technology outcomes that may be relevant to several subject areas.

Specific Learning Outcomes: The specific learning outcomes outline what students must know and be able to do in relation to the activities; in other words, the knowledge and skills that students must acquire to achieve the content standards.

Suggested Resources: The list of suggested resources will facilitate the successful completion of each identified activity. However, teachers may also use other resources that are available in their environment. The full list of essential resources associated with each component has been included in the Appendices.

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Traditional Information and Communication Technologies

From Drums to Television

Content Standards

- ➢ *Describe traditional forms of information and communication technologies*
- ➢ *Use modern and emerging information and communication technologies to communicate information*
- ➢ *Locate information to answer research questions, using a variety of sources, such as printed texts, bulletin boards, biographies, art, music, community resource persons, CD-ROMs, and the Internet*

Context

Throughout history there have been many devices and systems invented to facilitate communication between people. These devices started with the use of drums and today extend to the radio and television.

Challenge

Your group is required to research these early devices using textbooks and other relevant print sources, related CD-ROMs, and/or the Internet. Explain, with supporting evidence, the specific design, purpose, and function of each device. Also provide examples of the use of each device. Organize your research information and include images and illustrations. In a multimedia format, for example, slide show, video or audio, present the information to your class.

Specific Learning Outcomes

You will be able to:

- plan and conduct a search, using a wide variety of sources;
- demonstrate the ability to control devices electronically;
- identify traditional communication media;
- describe the purpose of different traditional communication devices;
- present examples of the use of each communication devices identified.

Suggested Resources

Textbooks, CD-ROMs, Internet access

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Traditional Information and Communication Technologies

Introduction to Visual Communication

Content Standards

➢ *Manipulate lines and basic geometric shapes to compose drawings and pictures*

Context

From early illustrations on the walls of caves to computer-aided design, drawing has been an effective mode of communicating ideas and information. It is said that a picture is worth a thousand words. Similarly, in Technology Education, each solution begins with a design or a sketch. Students must therefore begin to appreciate the basics of design as it relates to visual communication.

Challenge

Your group is required to sketch the objects provided using rule-assisted sketching techniques. Your drawings must be neat, clean, look like the actual object, and be in correct proportion.

Specific Learning Outcomes

You will be able to:

- draw neat and clean drawings;
- produce an accurate drawing of an object;
- draw items in correct proportion.

Suggested Resources

Objects to be drawn, 8 ½" x 11" paper, ruler, pencil, and eraser

Note: Teachers with AutoCAD resources may modify this activity to suit the needs of a school or area. The use of rulers and drawing boards is acceptable, but in the era of computer-assisted technologies it is important to move forward.

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: New and Emerging Information and Communication Devices

Digital Communication Devices

Content Standards

➢ *Describe new and emerging forms of information and communication technologies*

Context

Mobile communication devices offer opportunities for facilitating learning. These devices include digital cameras, camcorders, and digital voice recorders. One educational use of these devices is to capture sound, pictures, and video and to download them to the computer to be used in projects. Similarly, some elements of lessons and projects could be uploaded to these devices for review.

Challenge

Your group is required to install and connect these various devices to the computer and download their data to an appropriate file on the computer. The following is the list of data transfers that must be accomplished;

1. Download digital pictures, video, and sound files to the computer
2. Upload and share files with other groups
3. Using flow charts, record the steps taken to complete each task

Specific Learning Outcomes

You will be able to:

- install drivers for digital devices;
- download data from digital devices to the computer;
- share data between digital devices;
- upload data to digital devices.

Suggested Resources

Computer, Internet access, digital cameras, camcorders, digital voice recorders, drivers for the various devices

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: New and Emerging Information and Communication Devices

Audiovisual Presentations

Content Standards

➢ *Develop multimedia presentations using appropriate audiovisual technologies*

Context

Microsoft PowerPoint is a powerful tool used for creating professional-looking presentations and slide shows. PowerPoint allows you to create presentations from scratch or by using the Wizard. This program allows you to make presentations using animated graphics, text, pictures, sounds, and movies. It is widely used by business people, educators, students, and trainers and is among the most accepted forms of persuasion technology.

Challenge

Your group is required to produce a 5-slide presentation based on a theme of your choice. This presentation must be visually pleasing, and should include animation, text, clipart, Word Art, pictures, or movies. The final slide must be a digital picture of your group. Use flow charts to record the steps taken to complete the various tasks.

Specific Learning Outcomes

You will be able to:

- create a slide show using Presentation software;
- use animation, graphics, and movies to enhance your presentation.

Suggested Resources

Computer, Internet access, Microsoft PowerPoint, digital camera

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: New and Emerging Information and Communication Devices

Video Production

Content Standards

➢ *Develop multimedia programmes using appropriate audiovisual technologies*

Context

Video cameras allow you to take pictures and videos, which can be edited to make movies. Video cameras are used for recording weddings, birthday parties, and school activities and have even provided news agencies with footage of natural disasters and other newsworthy items.

Challenge

Your team has to make a 5-minute movie using the video camera. The theme of the movie should be one that promotes good values and morals in your school. Your movie should be entertaining, with a good story line, and clear sound and video.

Specific Learning Outcomes

You will be able to:

- develop a story board for the production of a video;
- operate the camcorder skilfully and safely;
- prepare the necessary props, and audio and visual aids;
- produce a video recording;
- link the camcorder to the computer;
- edit the video.

Suggested Resources

Computer video card with external inputs, Internet access, video camera, video camcorder, TV, VCR, VCR tape

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: New and Emerging Information and Communication Devices

Desktop Publishing

Content Standards

➢ *Design, develop, publish, and present products, e.g., Web pages, newsletters, cards, and reports using appropriate technologies*

Context

Microsoft Publisher helps you create, customize, and publish materials such as newsletters, brochures, flyers, catalogues, and Web sites. The use of the computer in the creation of your own business cards/bookmarks will save you the cost of having to go to the printer.

Challenge

Your group has started a new business and is having its grand opening. Design and make a business card to give to potential customers and a bookmark to give away as a keepsake. All items must have the company's name and logo and should be attractive. These are items that you will need by the hundreds, so you should print the maximum amount of items per 8½" x 11" sheet. For the business card, 8 copies per sheet, and the bookmark, 4 copies per sheet. Some copies will be given to VIP customers and need to be laminated.

Specific Learning Outcomes

You will be able to:

• operate the Publisher application;
• create cards using Publisher;
• print multiple copies per sheet;
• laminate the cards for added protection.

Suggested Resources

Computer, Internet access, Microsoft Publisher

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Communication Skills

Introduction to Computers

Content Standards

➢ *Use new and emerging information and communication technologies to communicate information*
➢ *Demonstrate a basic understanding of the operating skills required to use a variety of technologies*
➢ *Use keyboarding skills to compose, revise, and edit text*

Context

To be computer literate, one must possess knowledge and understanding of computers, combined with the ability to use them effectively. This knowledge includes the ability to navigate the operating system with the use of various input devices such as the mouse and keyboard.

Challenge

Your group is required to complete the following task, and to record the steps using a flow chart:

1. Turn the computer on and off safely
2. Change the wallpaper and screensavers
3. Open, minimize, maximize, restore, and close applications
4. Open multiple applications and navigate between them

When you are familiar with the basics of operating the computer, each member of your group needs to practise keyboarding technique. Use the typing tutorial to build your typing speed to 20 words per minute.

Specific Learning Outcomes

You will be able to:

• input text using appropriate keyboarding techniques;
• use basic features of an operating system;
• identify and distinguish icons of different applications.

Suggested Resources

Computer with Windows operating system; Microsoft Word, Typing tutorial

Note to Teacher: It is important that all students operating in a group should contribute meaningfully to the project. Some students may have higher levels of competence in computer literacy and applications. Such strong groups may benefit from a different computer activity, which they will find more challenging and engaging.

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Communication Skills

File Management

Content Standards

➢ *Use new and emerging information and communication technologies to communicate information*
➢ *Demonstrate a basic understanding of the operating skills required to use a variety of technologies*

Context

A file is data or information stored in an electronic format. When you save your work on the computer it is saved as a file. How you organize your files on your computer or storage devices will determine how quickly and easily you can retrieve those files. When saving files, names used should be as descriptive as possible; write the full name of the project. Files stored on the computer accumulate over time; if they are not properly named and organized you may find them difficult to retrieve.

Challenge

Your group has to create a filing system on your flash drive for all your subjects. It should comprise of a directory of folders and sub-folders. The Technology Education folder will contain sub-folders for the four components of Technology Education. For each component of technology education, you will be getting assignments and notes. You will be given an electronic copy of this assignment; save it in the appropriate folder. Draw a directory tree diagram showing the structure of your filing system on paper. This is to be presented along with your flash drive. You will receive more electronic assignments as the term progresses and your flash drive must be maintained and updated.

Specific Learning Outcomes

You will be able to:

- draw a directory tree diagram of a computer filing system;
- create and rename folders on your storage device;
- correctly select root folder and place sub-folders into them;
- save and open a file to various storage devices.

Suggested Resources

Computer with Windows operating system, Microsoft Office suite, rewriteable CD, flash drive

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Communication Skills

File Management

Content Standards

➢ *Use new and emerging information and communication technologies to communicate information*
➢ *Demonstrate a basic understanding of the operating skills required to use a variety of technologies*
➢ *Use keyboarding skills to compose, revise, and edit text*
➢ *Use word processors, spreadsheets, and databases to organize and manipulate data*

Context

The use of computers in the preparation of documents has become indispensable in modern businesses. Word processing software allows one to create, edit, and print text documents quickly and efficiently. There are many word processing programs available. Among the more popular ones are Microsoft Word and Word Perfect.

Challenge

You are required to create a document using the keyboard. First, type the given document following the layout and instructions. Now make the following changes to the document:

1. Change the order of the paragraphs
2. Change all occurrences of the word …………. to………..
3. Change the title of the document to all capitals without rewriting it
4. Change the font and colour of the text
5. Highlight sentences using a colour of your choice
6. Insert a clip that best describes the document

Specific Learning Outcomes

You will be able to:

- edit a Word document using various formatting functions;
- use the spelling and grammar function;
- insert clip art into a document.

Suggested Resources

Various types of documents, Computer with Windows operating system, Microsoft Office suite

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Communication Skills

Computer-Aided Design

Content Standards

➢ *Manipulate lines and basic geometric shapes to compose drawings and pictures*

Context

The computer is a powerful drawing tool. Many computer programs can be used to produce neat and accurate drawings; one such program is AutoCAD. This program allows you to create an accurate drawing by entering its dimensions. The advantages of using a computer-based drawing program in the production of accurate drawings are: (a) the ability to enter precise measurement, (b) the ability to easily edit drawings, and (c) that each print made is an original print.

Challenge

Your team has to use the AutoCAD drawing program to draw the pictorial and orthographic views of the object provided. After you have completed the drawings, print them.

Specific Learning Outcomes

You will be able to:

- use menus and toolbars to input lines and shapes that will comprise an object;
- draw an accurate 3-dimensional isometric view of an object using AutoCAD;
- draw the accurate orthographic views of an object using AutoCAD;
- apply standard dimensioning techniques to the drawing;
- print drawings created in AutoCAD.

Suggested Resources

Objects to be drawn, Computer, Internet access

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Research Skills

Internet Research

Content Standards

➢ *Appreciate the new and emerging technologies available to acquire and communicate information*
➢ *Use electronic research techniques to acquire, organize, evaluate, and communicate information on new and emerging technologies*
➢ *Demonstrate a moral and ethical approach to the use of technology*

Context

The digital camera is a fairly new piece of technology that is now used for any and all occasions. Most users do not know how digital cameras work but use them in ways that are not always moral or ethical.

Challenge

Your group has to research the digital camera and present your findings in the form of a report. Your report must include a definition of the digital camera and five pictures of different makes and models of cameras, along with their specifications and cost. Choose one of the digital cameras on your list and explain three of its specifications. Make a short list of unethical ways in which a digital camera may be used. The sources for all of the information and pictures that were gathered for this report must be included.

Specific Learning Outcomes

You will be able to:

- research information using various sources of references;
- navigate the Internet;
- download and save information from the Internet;
- describe the impact of the Internet on business and education.

Suggested Resources

Computer, Internet access

Activity Sheet

Component: Information and Communication Technologies

Sub-Component: Research Skills

Research and Create a Report on the Internet

Content Standards

➢ *Use electronic research techniques to acquire, organize, evaluate, and communicate information*
➢ *Use new and emerging information and communication technologies to communicate information*
➢ *Demonstrate a moral and ethical approach to the use of technology*

Context

The Internet is a worldwide, publicly accessible network of interconnected computers that transmits data. The Internet is a communication and information resource that is comprised of millions of smaller domestic, academic, business, and government networks, which together provide information and services, such as electronic mail, online chat, file transfer, and the interlinked Web pages and other documents of the World Wide Web. The Internet is increasingly being seen as a resource to enhance the teaching and learning process in this technological age.

Challenge

Your group has to use the Internet, using at least two search engines, to research the evolution of the Internet. Save the web pages visited as favourites, and save them on your flash drive at the end of your research. Create a one-page report on what you have found; it should document the Internet addresses that you used in your research.

Specific Learning Outcomes

You will be able to:

• turn on the computer and log on to the Internet;
• use basic search engine features to browse the Internet;
• download relevant documents and save them to your flash drive;
• create an e-mail account using your preferred provider and send e-mail to another address;
• print documents.

Suggested Resources

Computer, Internet access

Materials Technologies

The Materials Technologies component of the Technology Education curriculum involves students in the conversion or modification of raw and processed materials by mechanical, electronic, or chemical means to develop a value-added product. This component examines concepts such as designing, processing, constructing, manufacturing, and maintenance. It deals with issues of supply, manufacture, preparation, storage, and marketing. The Materials Technologies component will also involve students in active production of a variety of goods and services that are designed to solve problems.

Definition

Materials Technologies refers to those technologies that alter the way in which raw materials are made and utilized. They include chemical and mechanical devices that make life easier for the worker and add value to products.

The component **Materials Technologies** is divided into four sub-components:

*Traditional Materials and Processes***:** This sub-component involves the use of traditional materials that give stiffness, strength, and shape to items we produce. Examples of traditional materials are wood, metals, plastics, and silica. They are generally difficult to cut and require the use of sharp-edged tools in cutting, shaping, and finishing them.

New and Emerging Materials and Processes: This sub-component involves the use of new materials, such as Polyvinyl chloride (PVC), Medium Density Fiberboard (MDF), gypsum, Styrofoam, ceramics, superconductors, shape memory alloys, metal muscle, and other emerging materials being developed for production.

Food Preparation: This sub-component involves the application of knowledge and skills to plan, make, and present good quality meals. Students will be exposed to principles of food preparation that will encourage the safe use of nutritious and wholesome foods. Students will work with foods such as dairy products, meats, fruits, vegetables, ground provisions, legumes, and grains. They will employ particular knowledge and skills to prepare suitable products for people with special needs.

Textiles Technology: This sub-component involves the application of knowledge and skills to plan, design, and make good quality textile products. The term *textiles* refers to any product made from processing of natural or synthetic fibres. Fibres may be twisted, woven, knitted, bonded, or otherwise processed into fabrics. They can be used for both protection and decoration. Textiles technology can help students to understand how textiles products are made and the processes involved.

Content Standards

1. Demonstrate knowledge and understanding of the properties of various materials.

2. Appreciate the relationship between the properties of materials and their beneficial or harmful usage.

3. Demonstrate a high standard of craftsmanship in the construction of items.

4. Demonstrate skill in designing well-made products.

5. Display the ability to combine different materials to develop appropriate products.

6. Demonstrate skill in performing the essential processes and techniques in manipulating materials.

7. Demonstrate skill in the use of appropriate tools and equipment .

8. Appreciate the advantages of using labour-/time-saving technologies in processing materials.

List of Activities

Sub-Components	Activities
Traditional Materials and Processes	Storage System
	Recycled Material
	Exercise Device
New and Emerging Materials and Processes	PVC Hanging Device
	Plastering Tool
	Custom-Made Tiles
Food Technology	Combined Breakfast Item
	Labour-/Time-Saving Devices
	Health Management
Textiles Technology	Safety Gear
	Costume Making
	Textile Technique

Activity Sheet

Component: Materials Technologies

Sub-Component: Traditional Materials and Processes

Storage System

Content Standards

➢ *Identify materials traditionally used in the production of useful items*
➢ *Assess the benefits arising from the properties of traditional materials*
➢ *Identify the processes used in working with traditional materials*
➢ *Assess the benefits and costs arising from the use of traditional materials*

Context

Lack of storage is one of the most common complaints of homeowners. Adequate storage alleviates stress by making items more accessible and delivers more living space by reducing clutter. Well-designed storage items can also be aesthetically pleasing and add to the overall atmosphere of a given space. At home, finding easy and affordable storage solutions for comfort and organization is essential.

Challenge

Your group is required to design and make a product that would alleviate a problem of storage in the home. It should be attractive, safe, and able to support a weight between 5–10 kg.

Specific Learning Outcomes

You will be able to:

- identify a storage problem in the home;
- design a product to store items weighing between 5–10 kg;
- select appropriate traditional material/s;
- identify the appropriate production processes to be used with the selected material;
- build a storage device;
- test the product against specifications.

Suggested Resources

Wood, metal, plastic, hand tools, equipment, magazines, adhesives, nails, finishing material, texts, Internet access

Activity Sheet

Component: Materials Technologies

Sub-Component: Traditional Materials and Processes

Recycled Material

Content Standards

➢ *Identify materials traditionally used in the production of useful items*
➢ *Assess the benefits arising from the properties of traditional materials*
➢ *Identify the processes used in working with traditional materials*
➢ *Assess the benefits and costs arising from the use of traditional materials*

Context

Waste materials are disposed of in various ways, such as by composting, incineration, open burning, or indiscriminate dumping on open land, or in landfills, rivers, and coastal waters. Sound management of waste materials contributes to a safe environment and a healthy society. Recycling of waste material is an effective solution to the problem of solid waste. Useful and interesting products can be produced using recycled materials.

Challenge

Your group is required to design and make a product using recycled materials to solve a problem of waste disposal in your community. The product must be safe, attractive, and must not cost more than $20.00.

Specific Learning Outcomes

You will be able to:

- identify various types of waste arising from the use of traditional materials;
- identify the problems involved in disposal of waste;
- identify problems in the community arising from waste;
- select a problem that may be solved using the recycling process;
- make a product using recycled traditional materials.

Suggested Resources

Traditional waste materials, hand tools, equipment, adhesives, nails, finishing materials, texts, magazines, Internet access

Activity Sheet

Component: Materials Technologies

Sub-Component: Traditional Materials and Processes

Exercise Device

Content Standards

➢ *Identify materials traditionally used in the production of useful items*
➢ *Assess the benefits arising from the properties of traditional materials*
➢ *Identify processes used in working with traditional materials*
➢ *Assess the benefits and costs arising from the use of traditional materials*

Context

Exercise benefits the body in many ways and persons are being encouraged to exercise. There is a market for exercise equipment, especially when readily available. Exercising at home will allow all family members, old and young, to participate. However, exercise equipment can be cumbersome and expensive. There is a need for exercising equipment that can be used in any home.

Challenge

Your group is required to design and construct an exercising device. An attractive finish should be applied to the product. Your report should include plans for promoting and selling the product.

Specific Learning Outcomes

You will be able to:

- identify the benefits of exercise to the human body;
- discuss the need for encouraging the use of exercise equipment;
- state the desirable features of such equipment;
- design a product using selected appropriate traditional material/s;
- identify the appropriate production processes to be used with the selected material;
- build exercise equipment;
- test the product against specifications;
- plan for the promotion and sale of a product.

Suggested Resources

Metal pieces, hand tools, equipment, finishing materials, safety gear, sports equipment catalogues, texts, Internet access, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Materials Technologies

Sub-Component: New and Emerging Materials and Processes

PVC Hanging Device

Content Standards

➢ *Identify new and emerging materials*
➢ *State significant properties of materials identified as new and emerging*
➢ *Identify processes used in working with new and emerging materials*
➢ *Assess the benefits and costs arising from the properties of new and emerging materials*

Context

Hanging devices are very useful in the modern home. On many occasions, towels, clothes, and other household items are left lying around the house due to the lack of hanging apparatus. As a result, the home appears to be disorganized and untidy. Some traditional materials used to make some of these devices are sometimes inadequate to the task. Polyvinyl chloride (PVC) provides a simple, cheap solution.

Challenge

Your group is required to design and make a hanging device to accommodate kitchen towels using PVC. The device should be attractive, durable, and safe.

Specific Learning Outcomes

You will be able to:

• design a hanging device using the design process;
• identify the appropriate production processes;
• select appropriate tools for making a PVC hanging device;
• construct a hanging device using PVC;
• test the product against specifications.

Suggested Resources

Cutters, measuring tape, fine permanent pen, drills, resource persons, Internet access, texts

Activity Sheet

Component: Materials Technologies

Sub-Component: New and Emerging Materials and Processes

Plastering Tool

Content Standards

➢ *Identify materials considered new and emerging materials*
➢ *State significant properties of materials identified as new and emerging*
➢ *Identify the processes used in working with new and emerging materials*
➢ *Assess the benefits and costs arising from the properties of new and emerging materials*

Context

Wooden floats are used to achieve a smooth finish when plastering. Wood is heavy, tiring to fashion, and relatively expensive. There is a need to develop a new and improved float using a new and emerging material to produce a surface of high quality.

Challenge

Your group is required to design and make a plastering tool to produce smooth surfaces. The tool must be constructed using a new or emerging material. It should be lightweight, easy to manipulate, safe to use, and relatively inexpensive.

Specific Learning Outcomes

You will be able to:

- identify the characteristics of a good plastering tool;
- select appropriate new or emerging material;
- design a plastering tool using the design process;
- use the appropriate tools to construct the plastering tool;
- make a plastering tool using appropriate modern materials;
- test the product against specifications.

Suggested Resources

Styrofoam, Styrofoam cutters, adhesives, finishing materials, hand tools, equipment, resource persons, Internet access, texts

Activity Sheet

Component: Materials Technologies

Sub-Component: New and Emerging Materials and Processes

Custom-Made Tiles

Content Standards

➢ *Identify materials considered new and emerging materials*
➢ *State significant properties of materials identified as new and emerging*
➢ *Identify the processes used in working with new and emerging materials*
➢ *Assess the benefits and costs arising from the properties of new and emerging materials*

Context

Custom-made or one-of-a-kind products add distinction to decor. New and emerging materials and processes allow persons to develop individualized products. Selection of materials for design solutions is often influenced by local and cultural themes.

Challenge

Your group is required to design and construct by hand **one tile** for an identified use in the home. A report on custom-made tile techniques must be prepared and presented.

Specific Learning Outcomes

You will be able to:

• identify an appropriate household need and state the desired characteristics of a tile solution;
• select the appropriate new or emerging material;
• design a custom-made tile;
• use the appropriate tools to construct the custom-made tile;
• test the product against specifications.

Suggested Resources

Sand, bonding agent**,** cement, cultured marble powder, clay, gypsum, paint, epoxy, rolling pin, cutters, oven, paint brushes, glitter

Activity Sheet

Component: Materials Technologies

Sub-Component: Food Technology

Combined Breakfast Item

Content Standards

- ➢ *Identify food groups*
- ➢ *Identify nutrients in food*
- ➢ *Relate particular nutrients to food groups*
- ➢ *Assess the benefits of nutrients to the body*
- ➢ *Appreciate the nutrients found in local foods*
- ➢ *Identify the processes involved in food preparation*
- ➢ *Demonstrate knowledge and skills in the use of kitchen equipment, utensils, and gadgets*
- ➢ *Combine different foods or ingredients to present attractive dishes*

Context

Breakfast is the most important meal of the day. It provides the body with the necessary nutrients needed to start the day. Research studies done by students in Dietetics have revealed that the most common reason for not having breakfast is time constraints. As a result, persons who are in the habit of "skipping" breakfast are at risk of developing poor eating habits, which lead to poor health. Combined breakfasts allow individuals to meet their nutritional requirements in a short time.

Challenge

Your group is required to design a recipe and prepare a product that contains the essential nutrients of a well-balanced combined breakfast. This product should be tasty, include a local fruit, and be prepared in 15 minutes or less.

Specific Learning Outcomes

You will be able to:

- identify the nutritional contents of a well-balanced breakfast;
- design a recipe for a suitable breakfast item;
- produce a breakfast item in 15 minutes or less;
- test the product against specifications.

Suggested Resources

Assorted kitchen tools and equipment, assorted ingredients suitable for breakfast, recipe books

Activity Sheet

Component: Materials Technologies

Sub-Component: Food Technology

Labour-/Time-Saving Devices

Content Standards

➢ *Identify food groups*
➢ *Identify nutrients in food*
➢ *Relate particular nutrients to food groups*
➢ *Assess the benefits of nutrients to the body*
➢ *Appreciate the nutrients found in local foods*
➢ *Identify the processes involved in food preparation*
➢ *Demonstrate knowledge and skills in the use of kitchen equipment, utensils, and gadgets*
➢ *Combine different foods or ingredients to present attractive dishes*

Context

Labour-/time-saving devices are available on the market to increase the efficiency of food preparation. Some people lack the technological competence and skill to maximize the advantages of these devices. The ability to use them comes with knowledge and practice. There is a need for people to develop skills to use these devices effectively and safely.

Challenge

Your group is asked to select a labour- or time-saving device used in food preparation. Design and plan, produce and present a nutritious food item using the selected device in its preparation.

Specific Learning Outcomes

You will be able to:

- identify and select an appropriate labour-/time-saving device used for food preparation;
- demonstrate the appropriate psychomotor skill(s) utilized in operating the selected device;
- design a recipe that will require the use of the selected device;
- indicate, in describing the recipe, how the selected device will be used;
- identify the nutritional contents of the food item produced;
- prepare and serve a food item.

Suggested Resources

Labour-/time-saving devices and technologies, Internet access, library, resource personnel, assorted ingredients, assorted cooking utensils, recipe books, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Materials Technologies

Sub-Component: Food Technology

Health Management

Content Standards

➢ *Identify food groups*
➢ *Identify nutrients in food*
➢ *Relate particular nutrients to food groups*
➢ *Assess the benefits of nutrients to the body*
➢ *Appreciate the nutrients found in local foods*
➢ *Identify the processes involved in food preparation*
➢ *Demonstrate knowledge and skill in the use of kitchen equipment, utensils, and gadgets*
➢ *Combine different foods or ingredients to present attractive dishes*

Context

Chronic diseases present the greatest public burden in our society. A poor diet is one of the factors that contribute to the onset of chronic diseases. Chronic diseases are lifelong and can be managed by developing a healthy lifestyle that includes an appropriate diet.

Challenge

Your group is required to design and develop a product that would be suitable for a diabetic. It should also be suitably packaged and labelled to be marketed at a health fair.

Specific Learning Outcomes

You will be able to:

• assess the effects of food groups and nutrients on the diabetic person;
• identify the ingredients suitable for preparing food for the diabetic person;
• produce a food product suitable for the diabetic person;
• package and label food product for marketing;
• price items competitively.

Suggested Resources

Assorted cooking tools and equipment, Internet access, library, resource personnel, assorted ingredients, recipe books, packaging material, labels, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Materials Technologies

Sub-Component: Textiles Technology

Safety Gear

Content Standards

- ➢ *Identify the sources of various fibres and yarns*
- ➢ *Identify the properties of various fibres and yarns*
- ➢ *Identify the processes involved in manufacturing fabrics.*
- ➢ *Demonstrate the relationship between type of fabrics and appropriate usage*
- ➢ *Identify processes involved in constructing simple fabric items*
- ➢ *Demonstrate knowledge and skills in the use of sewing tools and equipment*
- ➢ *Demonstrate essential processes and techniques entailed in making simple items*

Context

Safety refers to the precautions people take to prevent accidents. A knowledge and understanding of safety practices and procedures are essential in any working environment. One safety precaution is the wearing of safety gear. Protective gear should be worn to protect individuals from injuries and other dangers. Some people do not take this practice seriously since they do not see the danger involved.

Challenge

Your group is required to design and produce an item of safety gear for students working in the food laboratory at your school. The selected gear should be made of materials suitable for its function and should be able to fit standard size wearers.

Specific Learning Outcomes

You will be able to:

- describe a situation where safety is an issue;
- design an item of safety gear appropriate for use in that situation;
- select suitable fabric for the design;
- state the characteristics of good safety gear;
- apply the appropriate processes and techniques to produce the item;
- test the product for specifications.

Suggested Resources

Internet access, library, resource personnel, assorted fabrics, assorted threads, sewing machine, sewing hand tools, safety magazines, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Materials Technologies

Sub-Component: Textiles Technology

Costume Making

Content Standards

➢ *Identify the sources of various fibres and yarns*
➢ *Identify the properties of various fibres and yarns*
➢ *Identify the processes involved in manufacturing fabrics*
➢ *Demonstrate the relationship between type of fabrics and appropriate usage*
➢ *Identify processes involved in constructing simple fabric items*
➢ *Demonstrate knowledge and skills in the use of sewing tools and equipment*
➢ *Demonstrate essential processes and techniques entailed in making simple items*

Context

Our country has a number of festivals and other occasions on which costumes are an integral part of the celebrations. Beautifully designed costumes display creativity but may also provide viewers with historical or social data. Costume designers must be able to choose the appropriate fabrics and accessories and employ a variety of artistic and construction skills to achieve their goals.

Challenge

As costume designers, your group is asked to design and make a costume appropriate to an identified event or theme. Costumes will be evaluated according to theme relevance, use of colour, and incorporation of a variety of construction skills (e.g., wire-bending).

Specific Learning Outcomes

You will be able to:

• select a theme or portrayal appropriate to an event;
• design a costume that fits the selected theme or event;
• state the characteristics of good costume design and construction;
• construct the costume using appropriate processes;
• test the product in line with specifications.

Suggested Resources

Assorted fabrics, Velcro, graph paper, foil, elastic, fastenings, beads, braids, feathers, fabric dyes and paints, fabric crayons and pens, thread, wire, pliers, scissors, glue guns, paint brushes, tape measure, hammers, saws, sewing equipment, resource persons, Internet access

Activity Sheet

Component: Materials Technologies

Sub-Component: Textiles Technology

Textile Technique

Content Standards

➢ *Identify the sources of various fibres and yarns*
➢ *Identify the properties of various fibres and yarns*
➢ *Identify the processes involved in manufacturing fabrics*
➢ *Demonstrate the relationship between type of fabrics and appropriate usage*
➢ *Identify processes involved in constructing simple fabric items*
➢ *Demonstrate knowledge and skills in the use of sewing tools and equipment*
➢ *Demonstrate essential processes and techniques entailed in making simple items*

Context

Human beings have always sought to embellish their clothing and household items. Hand embroidery techniques have been developed in every culture. Currently, these techniques have a commercial presence as logos are embroidered on uniforms, T-shirts, and school shirts. Hand-sewing techniques have developed in response to the changing needs and technological developments in society. Today, embroidery is a technique that can be generated with the assistance of computer programs, but handiness with needle and thread is still a valuable skill.

Challenge

Your group is required to design and produce an embroidered item depicting an appropriate theme or logo for a sports day. Your group must be prepared to compete with others for a contract to supply an order of the item for 500 persons. Your display must include a chart showing how embroidery techniques have evolved over time.

Specific Learning Outcomes

You will be able to:

- select an appropriate theme;
- design an embroidered item that fits the selected theme;
- state the characteristics of good embroidery design;
- construct the embroidered item using appropriate processes;
- prepare items for competitive display;
- price items competitively;
- prepare a chart on the evolution of embroidery techniques.

Suggested Resources

Internet access, Technology Education text, sewing text, selection of embroidery thread, fabric, embroidery needles, sewing accessories, computer embroidery machine and program, computer embroidery manual

Energy and the Built Environment

The Energy and the Built Environment component of Technology Education exposes students to the human use of energy; in particular, the way in which humans make machines work for them. It also provides opportunities for students to observe how the natural environment has been altered for man's benefit, through the use of sophisticated energy sources. Finally, it looks at the social costs associated with the employment of more sophisticated energy sources.

Definition

Energy can be defined as the ability or capacity to do work. Whatever the form of energy, producers are concerned with the generation, transmission, and distribution of energy and the needs of the end-user. Currently, the main energy source used is fossil fuels, but alternative sources of fuels are necessary to continue our progress. While we search, we need to increase the efficiency with which we use energy.

The Built Environment can be defined as the alteration of the natural environment to accommodate human needs for food, shelter, and clothing as well as other wants. In order to meet both needs and wants, man has developed production systems resulting in larger buildings, more complex transport systems, and places of leisure.

In this curriculum, **Energy and the Built Environment** is divided into four sub-components:

Energy Use Over Time: Human beings use energy all the time. Some of it is produced by our bodies, but, over the years, the energy produced from external sources has allowed us to industrialize and prosper. The first major revolution in the use of energy was the discovery of fire, and fire continues to be used as a source of energy to the present day, even as we explore the possibilities of nuclear power arising from fission and fusion. Currently, the amount and kind of energy used differs at different times of the year, in different areas, and among different countries.

Sources of Energy: Sources of energy include fossil deposits, the sun, wind, water, wood, metals, and air. Society is concerned with the generation, distribution, and efficient use of energy. Crude oil and natural gas are two resources extracted from fossil deposits and refined in our country for local and international use. Energy sources are converted and stored for use by machines and other devices, but pollutants are undesirable by-products. The search for alternative energy sources has become crucial since fossil fuel reserves are dwindling and expensive.

Conservation of Energy: When there is a shortage of inexpensive fuel, there is a need for conservation efforts such as increased efficiency in generating, distributing, and using energy; avoidance of waste; and increased research into alternative sources. Better-designed machinery can utilize energy more efficiently, which in turn reduces cost and increases productivity.

Environmental Design: Human beings have sought to meet their basic needs by creating intricate systems based on understanding and applying physical, biological, and chemical laws, such as the relationship among design, structure, and function. Human activity occurs in places ranging from large-scale civic surroundings such as industrial estates to personal spaces such as homes. These artifacts of the built environment use a tremendous amount of human, mechanical and other types of energy. Cultural meanings and influences also influence how we develop our physical environment, both interior and exterior.

Content Standards

1. Appreciate the relationship between energy use and human development.

2. Identify the characteristics of various energy sources.

3. Evaluate the roles and functions of various energy sources.

4. Assess the benefits and costs of using energy from different sources.

5. Appreciate the need for efforts at conserving energy.

6. Identify the features of the built environment.

7. Appreciate the built environment as the result of the application of scientific laws and technical skills.

8. Evaluate the relationship between environmental design and human development.

List of Activities

Sub-Components	Activities
Energy Use Over Time	Energy Evolution Pictogram
	Discovering Your Energy Usage
	Building a Lifting Device
Sources of Energy	Building an Energy Converter
	Air-Powered Devices
	Building a Solar Heat Exchanger
Conservation of Energy	Aerodynamically Efficient Shapes
	Improving Fuel Efficiency
	Energy Efficiency Rating Chart
Environmental Design	Conveyor Belt
	Bridge Building
	Play Park

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Energy Use Over Time

Energy Evolution Pictogram

Content Standards

> *List examples of energy sources*
> *Relate periods of human development to use of energy*
> *Explain the causal relationship between energy use and human development*
> *Measure the costs of increased energy use over time*

Context

The history of man's use of energy sources other than his own began with his discovery of fire. Historians of industry suggest that there is a close link between man's increasing ability to harness a variety of energy sources and his capacity to produce goods and services.

Challenge

Your group is required to produce and present a display comprising a series of charts, documents, samples, models, pictures, and drawings of activities to show the stages in the development of energy sources over time. Show any link between increased use of energy sources and industrial developments.

Specific Learning Outcomes

You will be able to:

- define the term *energy source*;
- identify energy sources used over time;
- assess the relationship between energy sources and human productive activity, for example, manufacturing;
- mount a chronological display.

Suggested Resources

Internet access, Technology Education text, supplies store, resource persons, bristol board, staples, stapler, glue, glue sticks, markers, paint, paintbrushes, small plastic bags, thumbtacks, rulers, display area

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Energy Use Over Time

Discovering Your Energy Usage

Content Standards

- ➢ *List examples of energy sources*
- ➢ *Relate periods of human development to use of energy*
- ➢ *Explain the causal relationship between energy use and human development*
- ➢ *Measure the costs of increased energy use over time*

Context

In the early days of civilization, human beings depended on low energy producing sources, but over the last 100 years, societies have become high energy users. Many different forms of energy are produced but electrical energy is the most commonly used. The great demand for electrical energy in the home has major financial implications for the consumer.

Challenge

Your group is required to collect information on the electrical energy consumed in homes for **two** billing periods. List the number and types of appliances currently in use in the households under study, and research the amount of electrical energy each type of appliance consumes. Compute the relative cost of using a particular type of appliance and present your information in a creative way.

Specific Learning Outcomes

You will be able to:

- interpret electricity bills;
- read electricity meters;
- assess the impact on energy use of various appliances;
- explain variations in energy use over time.

Suggested Resources

Household electricity bills, household meters, Kwhr meters (analog/digital), manufacturers' manuals, multimedia equipment and other presentation materials, Technology Education text, Science and Math text, resource persons, electricity organizations, Internet access, books, magazines, newspaper articles

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Energy Use Over Time

Building a Lifting Device

Content Standards

➤ *List examples of energy sources*
➤ *Relate periods of human development to use of energy*
➤ *Explain the causal relationship between energy use and human development*
➤ *Measure the costs of increased energy use over time*

Context

Over time, increasingly complicated devices have been created to enable mechanical work to be done easily. These machines provide mechanical advantages so that tasks that are too difficult or dangerous for humans to perform can be carried out.

Challenge

Your group is required to report on different lifting devices that have been invented over time to provide mechanical support to accomplish various tasks. The group is to design and build a mechanical device that can lift a small object to a height of 20 cm, rotate it 30º to the left or right, and rest it on a higher level.

Specific Learning Outcomes

You will be able to:

- identify various lifting devices invented over time;
- assess the devices in terms of efficient use of energy;
- build a working lifting device;
- evaluate the efficiency of the device and make suitable modifications.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, wood, nuts, bolts and screws, syringes, pulleys, nylon fishing line, rubber tubing, small DC motors, miniature gear box, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Sources of Energy

Building an Energy Converter

Content Standards

➢ *Differentiate between different forms of energy*
➢ *Identify examples of conversion of forms of energy into different forms*
➢ *Identify the principles involved in energy conversion*
➢ *Identify the benefits and costs of using various energy sources*
➢ *Identify problems associated with different forms of energy*
➢ *Evaluate the efficiency of energy sources*

Context

There is a constant and wonderful array of energy transformation going on around us. However, we have not been able to take advantage of natural transducers effectively. Many of our attempts at converting energy forms result in energy loss as well as pollution, especially air pollution. It would be good if we could build a machine that is capable of converting clean and renewable energy into electrical energy

Challenge

Your group is required to design and build a safe and efficient device that converts one form of energy into another. Report on how you have made use of the principles involved and suggest which one is the more efficient form of energy.

Specific Learning Outcomes

You will be able to:

• define the term *transducer*;
• provide examples of transducers in nature;
• build a machine to convert one form of energy into another form;
• evaluate the efficiency of the energy converter and make modifications.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, wood, plastics, metals, screws, nuts and bolts, old fans, rubber, springs, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Sources of Energy

Air-Powered Devices

Content Standards

- ➢ *Differentiate between different forms of energy*
- ➢ *Identify examples of conversion of forms of energy into different forms*
- ➢ *Identify the principles involved in energy conversion*
- ➢ *Identify the benefits and costs of using various energy sources*
- ➢ *Identify problems associated with different forms of energy*
- ➢ *Evaluate the efficiency of energy sources*

Context

The squeal of brakes and certain doors results from the release of compressed air. The harnessing of air under pressure is useful to operate certain tools and equipment, and for other industrial purposes.

Challenge

Your group is required to design and build a device that uses compressed air as the source of power. Report on how you have made use of the principles involved and suggest whether this is the best source of energy.

Specific Learning Outcomes

You will be able to:

- define the terms *aerodynamics* and *compressed air*;
- identify the principles involved in using compressed air;
- build a device powered by compressed air;
- evaluate compressed air as a source of energy.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, bicycle pump, PVC pipes and fittings, stem (insert for bicycle pump), one litre soft drink bottle, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Sources of Energy

Solar Heat Exchanger

Content Standards

➢ *Differentiate between different forms of energy*
➢ *Identify examples of conversion of forms of energy into different forms*
➢ *Identify the principles involved in energy conversion*
➢ *Identify the benefits and costs of using various energy sources*
➢ *Identify problems associated with different forms of energy*
➢ *Evaluate the efficiency of energy sources*

Context

The sun is an enormous and almost perpetual nuclear reaction. We constantly make use of the sun's power to give us energy. There is an intricate energy exchange from the sun to man. Nations are looking towards solar energy as a way of solving their energy problems.

Challenge

Your group is required to design and build a device that is capable of raising the temperature of one litre of water 5º higher than the ambient (surrounding) temperature within 1 hour.

Specific Learning Outcomes

You will be able to:

- describe examples of transformation of solar energy to other forms of energy;
- identify problems associated with collecting and storing solar energy;
- build a solar heat exchanger;
- evaluate the efficiency of the solar heat exchanger;
- make alterations to improve the efficiency of the solar heat exchanger;
- assess solar energy as a means of supplying warm water on a large scale.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, electrical wire, magnifying glass, mirror, foil, containers, wood, metal, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Conservation of Energy

Aerodynamically Efficient Shapes

Content Standards

> ➢ *Define the term "energy conservation"*
> ➢ *Assess the impact of energy conservation efforts*
> ➢ *Describe measures designed to conserve energy*
> ➢ *Build devices to allow for energy conservation*

Context

Air behaves like a fluid, and energy is needed to overcome the force produced when solid bodies move through it. The greater the surface area of any moving vehicle or machinery in contact with the air the greater the air resistance. This is not desirable due to the great amount of energy needed to overcome air resistance. High fuel costs and the pollution fuel causes when it burns are some of the reasons why aerodynamically efficient shapes are desirable in vehicles.

Challenge

Your group is required to design and build a vehicle with a shape that can provide the least air resistance. Your group is also required to find a safe way of testing the efficiency of your shape.

Specific Learning Outcomes

You will be able to:

- define the term *aerodynamics*;
- identify the principles involved in aerodynamics;
- build a vehicle with the best aerodynamic shape;
- assess aerodynamic shapes and make alterations to improve efficiency;
- prove that air constitutes a resistance force to motion.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, fan blades, thin rubber band, Styrofoam blocks, wheels, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Conservation of Energy

Improving Fuel Efficiency

Content Standards

➢ *Define the term "energy conservation"*
➢ *Assess the impact of energy conservation efforts*
➢ *Describe measures designed to conserve energy*
➢ *Build devices to allow for energy conservation*

Context

As worldwide oil reserves dwindle, the cost per barrel of crude oil goes up; this directly affects the cost of gasoline. People are now trying to find new ways to gain more mileage from a tank of gas. New and accepted technologies are used to improve fuel efficiency. Energy-saving ideas do not have to be grand, and ideas on saving fuel may come from people without an engineering background.

Challenge

Your group must find a way to safely improve the fuel efficiency of a selected small gasoline engine. Provide a report on how fuel efficiency is measured.

Specific Learning Outcomes

You will be able to:

- discover ways in which gasoline can be utilized more efficiently;
- apply energy-saving techniques to small gasoline engines;
- assess solutions presented to the problem of improving fuel efficiency.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, a small gasoline engine, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Conservation of Energy

Energy Efficiency Rating Chart

Content Standards

➢ *Define the term "energy conservation"*
➢ *Assess the impact of energy conservation efforts*
➢ *Describe measures designed to conserve energy*
➢ *Build devices to support energy conservation*

Context

Research into the technologies used to invent and improve appliances also attempts to improve the efficiency with which energy is used. Such information can now be utilized by the consumer, since manufacturers often provide tips to customers on how they can reduce their electricity bill in various ways,

Challenge

Your group is required to develop a rating chart that compares the efficiency with which various appliances in the home use energy. Describe, briefly, ways in which persons can reduce the energy use of appliances in the home.

Specific Learning Outcomes

You will be able to:

- use the electrical specifications on home appliances to calculate power and energy usage;
- compare the energy consumption of different appliances that are used for similar jobs;
- identify ways in which households can reduce their energy consumption.

Suggested Resources

Internet access, library, resource personnel, display materials, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Environmental Design

Conveyor Belt

Content Standards

➢ *Identify human needs and wants*
➢ *Define the terms "built environment"; "environmental design"*
➢ *Relate human needs and wants to aspects of the built environment*
➢ *Appreciate the relationship among design, structure, and functionality shown in aspects of the built environment*
➢ *Describe careers that contribute to the built environment*

Context

Within the built environment, there are occasions when it is necessary to transport large quantities of people, goods, and materials over short distances. As a means of reducing the use of manpower, many electromechanical devices have been developed.

Challenge

Your group is required to design, construct, and operate a model of a multi-purpose conveyor belt. The prototype will be required to move an item of at least 2 kg in weight. Prepare and present a report on types of conveyor belts.

Specific Learning Outcomes

You will be able to:

- list situations in which a conveyor belt system is useful;
- describe types of conveyor belts;
- build a type of conveyor belt;
- test the conveyor belt against specifications.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, a small gasoline engine, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Environmental Design

Bridge Building

Content Standards

➢ *Identify human needs and wants*
➢ *Define the terms "built environment"; "environmental design"*
➢ *Relate human needs and wants to aspects of the built environment*
➢ *Appreciate the relationship among design, structure, and functionality*
➢ *Describe careers that contribute to the built environment*

Context

Key aspects of the built environment are structures designed to link persons separated by water courses. These structures have encouraged trade and economic development as goods and services are easily accessed by citizens.

Challenge

Your group is required to design and build a bridge that will be at least 15 cm wide and span a gap of 45 cm. You must test your completed bridge and prove that it will support a weight of at least 20 kg at the centre. Prepare and present a report showing the relationship among your design, the built structure, and its function.

Specific Learning Outcomes

You will be able to:

- describe problem situations where bridges would provide solutions;
- show how bridges contribute to economic development by facilitating access to markets for agricultural products;
- build a model of a bridge according to specifications;
- test the model against specifications and modify if necessary.

Suggested Resources

Internet access, texts, library, resource personnel, basic hand tools, wood strips, glue sticks and glue gun, metal strips, soldering gun, string, bobbin (geared motor), nail, utility knife, junior hacksaw, pulleys, gears, plastic tubing, syringes, T-adaptors, bridge building kit, tape, bridge tester with continuous pressure and deflection apparatus, hand cutters, and any other materials that meet the approval of the teacher

Activity Sheet

Component: Energy and the Built Environment

Sub-Component: Environmental Design

Play Park

Content Standards

> *Identify human needs and wants*
> *Define the terms "built environment"; "environmental design"*
> *Relate human needs and wants to aspects of the built environment*
> *Appreciate the relationship among design, structure, and functionality shown in aspects of the built environment*
> *Describe careers that contribute to the built environment*

Context

As people move into housing developments there is a need for safe and fun places for children to play. Children, ranging in age from toddlers to pre-teens, will require different types of enjoyable activities and other amenities.

Challenge

Your group is required to design and build a scale model of a play park that would provide a range of activities and amenities. Scale models of these activities should be included, as well as examples of the landscaping that would encourage safe use of the park by the children of residents.

Specific Learning Outcomes

You will be able to:

- collect and analyse information about the sorts of activities that will satisfy users of a built structure;
- design and construct a model of a built structure that responds to identified needs;
- evaluate the model's potential for user satisfaction.

Suggested Resources

Internet access, library, resource personnel, basic hand tools, modelling blocks, model figures, paper, and any other materials that meet the approval of the teacher

Biological Technologies

The Biological Technologies component provides students with an opportunity to use biological systems to solve problems in a sustainable and environmentally friendly manner. The field of Biological Technologies is comprised of a number of different elements, and so is conceptualized differently in different contexts. The conceptualization of the subject that is used in this curriculum document was arrived at after extensive consultation with stakeholders and consideration of our national needs. In Trinidad and Tobago, the application of biological technologies is limited to agriculture, medicine and health, environmental management, and food processing. Accordingly, the Biological Technologies component focuses on these four fields of activity.

Definition

Biological Technologies entails the use of organisms, parts of organisms, and supporting technologies to solve problems related to agriculture, food, health, and the environment.

In this curriculum, **Biological Technologies** is divided into four main areas:

Agricultural Technology: This sub-component focuses on the use of technology to improve the efficiency of crop and animal production.

*Medical and Health Technology***:** This sub-component involves the use of technology to assist in health and wellness management. It also includes the production of health care and beauty products using local materials.

*Environmental and Natural Resources Management Technology***:** This sub-component involves the use of technology to assess and manage the effects of man's action on the environment.

Biotechnology: This sub-component involves the use of living organisms or parts of organisms to make or modify organisms, biological systems, and products.

Content Standards

1. Use appropriate food preservation and processing methods for increasing the shelf life and value of primary agricultural produce.

2. Use appropriate technologies to maximize the efficiency of crop production systems.

3. Use appropriate technologies to maximize the efficiency of animal production systems.

4. Develop environmentally friendly systems of waste management using biological technologies.

5. Manage soils to maintain fertility using appropriate soil conservation and management methods.

6. Decorate an outdoor/indoor area to improve its attractiveness using natural materials.

7. Prepare for natural disaster to reduce loss of life and/or injury.

8. Produce herbal products for medicinal and beauty purposes from local plants.

9. Evaluate health and wellness in humans using various types of medical equipment.

10. Utilize microorganisms in processing primary agricultural produce.

11. Improve the efficiency of plant propagation using biological technologies.

12. Reduce the negative effects of man's action on the environment using microorganisms.

13. Identify commercial/entrepreneurial possibilities arising from biological technologies.

List of Activities

Sub-Components	Activities
Agricultural Technology	Extending Shelf Life of Primary Agricultural Produce
	Growing Condiments Using a Soil-Less Medium
	Rearing Ornamental Fishes
Environmental Management Technology	Converting Household Wastes into Useful Products
	Promoting Soil Conservation Through Education
	Decorating an Indoor Area Using Plants
Medical and Health Technology	Improving Access to Medical Supplies During Natural Disasters
	Developing Herbal Products From Local Plants
	Evaluating Health and Wellness Using Simple Medical Equipment
Biotechnology	Making Yogurt From Bacterial Culture
	Separation and Hardening of Tissue Culture Plantlets
	Managing Oil Pollution Using Biological Agents

Activity Sheet

Component: Biological Technologies

Sub-Component: Agricultural Technology

Extending Shelf Life of Primary Agricultural Produce

Content Standards

➢ *Use appropriate food preservation and processing methods for increasing the shelf life and value of primary agricultural produce*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

In Trinidad and Tobago, the supply of fresh agricultural produce is erratic; sometimes there are surpluses and at other times there are shortages. When produce is plentiful, prices are low and when it is scarce, prices are high. The supply of fresh agricultural produce can be made available throughout the year by increasing its shelf life. The shelf life of agricultural produce can be extended through food preservation and processing methods.

Challenge

Your group is required to extend the shelf life of local agricultural produce using suitable preservation and/or processing methods. The product should be tasty, attractive, and have a shelf life of at least seven days.

Specific Learning Outcomes

You will be able to:

- identify local agricultural produce with good potential for preservation and processing;
- identify and select suitable methods of preservation and/or processing;
- identify materials needed for preservation and/or processing of agricultural produce;
- develop food products using appropriate preservation and/or processing methods;
- evaluate food products using appropriate methods;
- identify business opportunities in food preservation and processing.

Suggested Resources

Local fruits and vegetables, basic kitchen utensils and equipment, food preservatives, aprons, hairnets, gloves, Internet access, literature on food preservation and processing

Activity Sheet

Component: Biological Technologies

Sub-Component: Agricultural Technology

Growing Condiments Using a Soil-Less Medium

Content Standards

➢ *Improve the efficiency of crop production systems using appropriate technologies*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

In Trinidad and Tobago, many homeowners are interested in growing vegetables and condiments for home use. Apart from having a ready supply of fresh vegetables and condiments, home gardening is considered a leisure-time activity that helps people to relax. However, many homeowners find it difficult to grow crops because of poor soil conditions.

Challenge

Your group is required to design and implement a system to grow condiments using a soil-less medium. The system should be environmentally friendly, relatively inexpensive, and occupy an area of approximately one square metre.

Specific Learning Outcomes

You will be able to:

• identify and select condiments that can be grown on soil-less media;
• prepare a soil-less medium from local materials;
• design a system for growing condiments using the soil-less medium;
• grow and maintain condiments from transplanting to harvesting;
• harvest condiments at correct stage of development.

Suggested Resources

Garden tools and equipment, fertilizers, pesticides, seedlings/seeds, materials for making soil-less mixtures, construction materials (e.g., board, bricks, PVC sheets), construction tools, Internet access, literature on soil-less culture

Activity Sheet

Component: Biological Technologies

Sub-Component: Agricultural Technology

Rearing Ornamental Fishes

Content Standards

➢ *Improve the efficiency of animal production systems using appropriate technologies*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

Aquaculture involves the rearing of fish and aquatic animals and plants in troughs and ponds. Fish can be reared for food or for ornamental purposes. Examples of fishes that are reared for food are *Tilapia, Cascadura*, and *Catfish*. Examples of ornamental fishes are *Koi, Goldfish,* and *Hilary*. There is a high demand for ornamental fishes in the local and foreign markets, and this can be a profitable business provided fish farmers can successfully rear healthy fishes.

Challenge

Your group is required to rear two species of ornamental fish up to marketable age. The system should be environmentally friendly, attractive, relatively inexpensive, and should provide good growing conditions for the fishes.

Specific Learning Outcomes

You will be able to:

• identify suitable species of ornamental fishes;
• design a system for rearing ornamental fishes;
• determine materials needed to set up the system;
• monitor and manage water quality during production;
• rear ornamental fishes for commercial production;
• identify marketable stage for selected fish species;
• identify business opportunities in ornamental fish rearing.

Suggested Resources

Fish tanks/aquariums, aquarium pumps, plastic tubes and fittings, air filters, biofilters, fish nets, aquarium decorations, water testing kit, measuring tape, fish food, aquatic plants, salt block, fish medication, literature on rearing ornamental fishes, Internet access

Activity Sheet

Component: Biological Technologies

Sub-Component: Environmental Management Technology

Converting Household Wastes into Useful Products

Content Standards

➢ *Develop environmentally friendly systems of waste management using biological technologies*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

Waste management companies are concerned about the amount of waste disposed by homeowners. Apart from the cost associated with its removal, landfill areas are becoming scarce and there is a possibility that we may soon have no place to dump our waste. It is therefore important to implement strategies to reduce, recycle, and reduce waste.

Challenge

Your group is required to design and make a useful product from household wastes. The product should be environmentally friendly, attractive, safe, and relatively inexpensive.

Specific Learning Outcomes

You will be able to:

- identify common household waste materials;
- identify products that can be made from waste materials;
- design and make useful products from household wastes;
- appreciate the importance of recycling and/or composting as useful means of waste management;
- identify the challenges in conversion of household waste into useful products.

Suggested Resources

Household wastes, decorative paints, adhesives, fabrics, cutting tools, Internet access, literature on recycling, stationery

Activity Sheet

Component: Biological Technologies

Sub-Component: Environmental Management Technology

Promoting Soil Conservation Through Education

Content Standards

➢ *Manage soils to maintain fertility using appropriate soil conservation and management methods*

Context

One of the problems affecting agriculture in the Caribbean is soil erosion. When there are bush fires, or when land is cleared for agricultural purposes, the soil is left bare and is exposed to agents of erosion. When rain falls, valuable topsoil washes away. This causes poor crop growth and reduced yields. In addition, erosion by water leads to silting of rivers, clogging of drains, and flooding.

Challenge

Your group is required to develop and implement an educational presentation, using at least two different communication media, to assist hillside farmers in preventing soil erosion. The programme should be interesting, informative, easy to implement, and should convey the message effectively.

Specific Learning Outcomes

You will be able to:

- identify soil conservation measures;
- select soil conservation measures that are appropriate for conditions in your community;
- design and make a presentation/models to demonstrate soil conservation practices;
- develop an understanding of the importance of soil conservation.

Suggested Resources

Basic stationery, markers, decorative paints, potters clay, digital camera, video recorder, computer, Internet access, literature on various modes of communication

Activity Sheet

Component: Biological Technologies

Sub-Component: Environmental Management Technology

Decorating an Indoor Area Using Plants

Content Standards

➢ *Decorate indoor/outdoor area to improve its attractiveness using natural materials*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

Aneisha has recently completed her Diploma in Ornamental Horticulture at the University of Trinidad and Tobago (UTT) and is employed as a landscape/interior designer. Her job is challenging but she enjoys it very much. She is frequently asked to create aesthetically pleasing environments with a "shoestring" budget. Very often, through her creativity and experience, she is successful in pleasing her clients. Aneisha enjoys her work very much and would like to continue her work as long as her health permits.

Challenge

Your group is required to beautify a room using horticultural materials costing not more than $200.00.

Specific Learning Outcomes

You will be able to:

• develop a beautification plan for an indoor area;
• identify materials needed for implementation of the plan;
• arrange materials to enhance the appearance of the area;
• calculate the cost of the interior design;
• identify business opportunities in the area of interior design.

Suggested Resources

Aquarium and accompanying fittings, water features, potted plants, cutting devices, decorative features, stones, pedestals, vases, ornaments, basic stationery, adhesives, literature on interior decorating, Internet access

Activity Sheet

Component: Biological Technologies

Sub-Component: Medical and Health Technology

Improving Access to Medical Supplies During Natural Disasters

Content Standards

➢ *Prepare for natural disasters to reduce loss of life and/or injury*

Context

Trinidad and Tobago can be affected by natural disasters such as hurricanes, floods, and earthquakes. As a result of these disasters, people can become sick or injured. Adequate preparation before disasters is important to prevent injury and loss of life. Very often, when disaster strikes people are unprepared—medical supplies are unavailable or inaccessible to care for the injured.

Challenge

Your group is required to design and produce a device for storing medical supplies in preparation for a hurricane. The device should be attractive, made from recyclable materials, and should allow for safe storage and easy retrieval of medical supplies.

Specific Learning Outcomes

You will be able to:

- identify ways of storing medical supplies;
- identify medical supplies in case of natural disaster;
- design a device for storing required medical supplies;
- identify suitable materials for producing the storage device;
- manipulate materials to produce the storage device.

Suggested Resources

First aid medical supplies, recyclable material, cutting tools, adhesives, fastening items (e.g., nails, screws, rivets) decorative paint, textbooks (e.g., National Safety Council's *First Aid* and *CPR Standard* (4th ed.), First Aid booklet provided by the Ministry of Health, disaster preparedness handouts, Internet access

Activity Sheet

Component: Biological Technologies

Sub-Component: Medical and Health Technology

Developing Herbal Products From Local Plants

Content Standards

➢ *Produce herbal products for medicinal and beauty purposes from local plants*

Context

Many of our local plants were used by our ancestors for medicinal and beauty purposes. In recent times, there has been renewed interest in herbal products, partly because they are cheaper and do not have the undesirable side effects of commercial products. Given this renewed interest, the manufacture of herbal products is potentially a good business for entrepreneurs.

Challenge

Your group is required to make a medical or beauty product using local plants. The product should be safe and easy to produce and should have a shelf life of approximately two weeks. It should also be attractively packaged,

Specific Learning Outcomes

Students will:

- identify local plants that can be used for medicinal or beauty purposes;
- identify methods of making herbal products from plant material;
- develop a herbal product using appropriate methods;
- develop a test to evaluate the herbal product;
- package and label herbal products;
- identify the challenges associated with the manufacture of herbal products from local materials.

Suggested Resources

Plant material with medicinal or beauty properties, air drying oven, electrical grinding mill, sieve, fractional distillation apparatus, basic laboratory glassware, blender, ceramic mortar

Activity Sheet

Component: Biological Technologies

Sub-Component: Medical and Health Technology

Evaluating Health and Wellness Using Simple Medical Equipment

Content Standards

➢ *Evaluate health and wellness in humans using various medical equipment*

Context

It is well established that individuals must take responsibility for their own health and avoid developing chronic diseases such as diabetes, hypertension, and obesity. Modern technology has enabled individuals to manage their health from the comfort of their homes. It is therefore important to use these devices competently in order to get correct measurements.

Challenge

Your group is required to assess the health of various individuals using three different types of medical equipment. The method should be simple and safe, and should provide an accurate assessment of health parameters. You are also required to record and interpret the state of health and wellness of the individual.

Specific Learning Outcomes

You will be able to:

- identify basic criteria for assessing health;
- use medical equipment competently and safely;
- record health parameters using appropriate systems;
- interpret health indicators to assess health and wellness.

Suggested Resources

Digital blood pressure kit, heart rate meter, tape measure, weighing scale, thermometer, exercise machine (treadmill), skin-fold calipers or body fat analyser, bone density equipment

Activity Sheet

Component: Biological Technologies

Sub-Component: Biotechnology

Making Yogurt From Bacterial Culture

CONTENT STANDARDS

➢ *Utilize microorganisms in processing primary agricultural produce*
➢ *Identify commercial/entrepreneurial possibilities arising from biological technologies*

Context

Yogurt is a health food that is popular throughout the world. It is made from milk by using a bacterial culture that increases the solid content and flavour of the product. Yogurt is reputed to be a health food—it aids in digestion, weight control, and bowel movement. Yogurt is relatively easy to make and offers good business opportunities.

Challenge

Your group is required to make 1 litre of flavoured yogurt for an obese person. The product should be safe to consume, tasty, attractively packaged, and have a shelf life of at least seven days.

Specific Learning Outcomes

You will be able to:

- identify various methods of making yogurt;
- identify indigenous materials for making yogurt;
- make yogurt with the indigenous materials using one of the methods;
- package yogurt appropriately using suitable containers;
- label the product according to a required standard;
- develop a procedure to evaluate the product;
- identify the challenges in using indigenous materials in yogurt manufacturing.

Suggested Resources

Basic kitchen utensils and equipment, milk, sugar, fruits, preservatives, yogurt maker, food colouring, literature on yogurt making, Internet access, access to resource persons in industry

Activity Sheet

Component: Biological Technologies

Sub-Component: Biotechnology

Separating and Hardening of Tissue Culture Plantlets

Content Standards

➢ *Improve the efficiency of plant propagation*

Context

The Biological Sciences Department of The University of the West Indies propagates plants by tissue culture. However, they do not have adequate facilities to separate and harden plantlets until they are ready for transplanting. Nurserymen find it profitable to buy the plantlets in jars and separate, harden, and grow them out until they are ready for transplanting.

Challenge

Your group is required to design and produce a system for separation and care of tissue culture plantlets. The system should enable you to harden a batch of 24 plantlets at a time and provide good conditions for growth of the plantlets.

Specific Learning Outcomes

You will be able to:

- separate tissue culture plantlets supplied in commercial jars;
- prepare growing media for transplanting plantlets;
- transplant plantlets to growing media;
- care for plantlets until they are ready for transplanting to the field;
- manipulate environmental conditions to support growth of plantlets;
- identify commercial/entrepreneurial possibilities arising from biological technologies;
- identify challenges in care of tissue culture plantlets.

Suggested Resources

Tissue culture plantlets (e.g., banana, orchids, anthurium), soil-less medium, hardening frames, household bleach, dibber, scalpel, rubber gloves, forceps, foliar fertilizer, pesticides, seedling trays, spray bottles, measuring cylinder, volumetric flask, scoop

Activity Sheet

Component: Biological Technologies

Sub-Component: Biotechnology

Managing Oil Pollution Using Microorganisms

Content Standards

➢ *Reduce the negative effects of man's actions on the environment by using microorganisms*

Context

Trinidad and Tobago has a vibrant energy industry involving the extraction and refining of crude oil. Very often, oil spillage occurs, which contaminates the environment. Oil pollution is very harmful to the environment and can result in the destruction of land and marine habitats. There is a need, especially in the oil industry, to clean up pollution in an efficient and environmentally friendly manner.

Challenge

Your group is required to design and produce a working model that can be used to clean up an oil spill. The system should be effective, environmentally friendly, and relatively easy to implement.

Specific Learning Outcomes

You will be able to:

- identify biological products for controlling oil pollution;
- apply biological products according to the manufacturer's instructions;
- design and implement a working model using biological products to control oil pollution;
- evaluate the effectiveness of the biological agent in controlling oil pollution;
- identify the challenges associated with using biological agents in controlling oil pollution.

Suggested Resources

Aquarium, plastic tubes and fittings, droppers, Formula 1 (biological control bacteria), used car engine oil, aquarium fish, gloves, petroleum pollution control handout, Internet access, access to resource personnel in industry

Part 5
Resources for Technology Education

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Appendices

Appendix A

Glossary

Technology has been defined as:

- a body of knowledge and the systematic application of resources to produce outcomes in response to human wants and needs;

- human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities;

- the modification, innovation, or changing of the natural environment, which is used to satisfy human needs and wants;

- the processes, tools, and techniques that alter human activity.

Very often, tools such as computers, productivity software, and peripheral devices are viewed as the main elements of technology; however, there is need to focus also on the processes that provide us with the conceptual tools which enable us to live and do work more efficiently and effectively. One approach is to distinguish between **hard** and **soft** technologies.

Hard technologies refer to such tools as computer hardware and software, calculators, fax machines, television and radio, and VCRs and other electronic devices.

Soft technologies refer to such processes as information management, need assessment, task analysis, data analysis, mind mapping, instructional design, time management, and collaboration with others. Students need to understand and apply both hard and soft technologies.

Technological Literacy: The ability to use, manage, understand, and assess technology.

Technology Education has been defined as:

- a study of technology, which provides an opportunity for students to learn about the processes and knowledge related to technologies that are needed to solve problems and extend human capabilities.

- a comprehensive, action-based educational programme concerned with technical means—their evolution, utilization, and significance; with industry—its organization, personnel, systems, techniques, and resources; and products and their sociological impact (International Technology Education Association, 1985)

Assessment: The process of gathering, describing, or quantifying information about performance.

Technology Education Laboratory: An environment that is designed to stimulate students of varying abilities to learn to use and create innovative designs and interesting modifications to already existing systems, and to familiarize themselves with the use of components and materials used for technology.

Appendix B

**Essential Resources for Conducting the Information and Communication
Technologies Component of the Technology Education Curriculum
(Based on a Class Size of 35 Students)**

Item No.	Quantity	Description
1	2	Multimedia projector
2	12	Desktop computers
3	12	Power backup and surge protector
4	12	Monitor (flat screen)
5	2	Printer
6	1	Scanner
7	10	Printer cartridge for item #5 (black and colour)
8	35	Flash drive (1GB)
9	1 with License	Computer software, Microsoft Office Word, Excel, Publisher, PowerPoint, Pinnacle Pro 1, video editing software
10	1	Web camera
11	2	DVD digital camcorder
12	2	Digital camera
13	1	Laminator
14	1 box	Laminator paper – Card (200 per box)
15	1 box	Laminator paper – Letter (100 per box)
16	1 box	Laminator paper – Tabloid (50 per box)
17	1	Poster printer
18	1 roll	Poster printer paper
19	1	Flat screen television
20	1	DVD recorder
21	1	Hand-held Labeller
22	1 roll	Labelling materials – 1.50"x.50" paper label (500 per roll)
23	1 roll	Labelling materials – .75"×3.0" white polyethylene (750 per roll)
24	1 roll	Labelling materials – .75" x 3" white polyethylene (100 per roll)
25	2 each	Heavy duty stapler – Long reach handle, minimum required effort, solid construction, approximate dimensions length 8.9" × width 2" ×height 5"; Throat depth 2.56"; Maximum sheet capacity 150 quantity; One-year warranty
26	1 box	Heavy duty staples
	2 each	Stapler Standard stapler-with a built-in staple remover
27	1 box	Standard staples
28	10 pairs	Stereo headphones; On the ear style; Wide Deluxe padded headband; Leatherette ear pads; In-line volume controls
29	2 each	Paper punch; 2- or 3-hole for binder and presentation; Punches up to 8 sheets of regular 20 lb. paper; Adjustable for 2-hole paper punching; Removable non-skid chip tray in base of punch; Durable all-metal construction

Item No.	Quantity	Description
30	1 only	Electric pencil sharpeners; All-steel cutter plus pencil saver to prevent over sharpening; Auto-reset thermal overload prevents overheating; Colour black; Approximate dimensions width 3" × depth 5" × height 4"; 120 V AC
31	1 only	CD/DVD label printer
32	1 case	CD-RW 20 per Jewel case printable
33	1 pack	CD-R 50 per pack printable
34	1 case	DVD-RW 30 per Jewel case printable
35	20	Audio cassette 10 per box (60 minutes)
36	1 box	VHS 4 per box (90 minutes)
37	1	Extension cords 25" roll up extension cords 14/3 "U" ground (white)
38	1	Power bars, with six outlets, spike protection and illuminated switch
39	1	Spiral binding machine
40	1	First aid kit includes 1½" bandages, 1" x 3" band aids, antiseptic wipes, cold packs, scissors, tapes, burn creams, plasters gauze pads, latex gloves, etc.
41	5 reams	Printing paper for printer
42	1 case	DVD-RW for DVD digital camcorder related to item 11 (30 per case)
43	1 box	Plastic combs ¼" thick to bind approximately 25 sheets (100 per box)
44	1 box	Plastic combs ½" thick to bind approximately 100 sheets (100 per box)
45	4 packs	Plastic paper clips (1" long; packs of 100)
46	1	Tripod for DVD camera
47	1	Thumb tacks
48	4 sets	Drawing instruments
49	1	Digital voice recorder

Appendix C

Essential Resources for Conducting the Materials Technologies Component of the Technology Education Curriculum (Based on a Class Size of 35 Students)

Food Preparation

Item No	Quantity	Description
1	6 each	Garlic press
2	6 each	Lime press
3	6 each	Knife sharpener
4	6 each	Egg slicer
5	6 each	Tomato slicer
6	6 each	Timer
7	1 dozen sets	Measuring spoons
8	1 dozen	Bowl sets
9	1 dozen	Measuring cup set
10	6 each	Pyrex liquid measuring cups
11	12 each	Stainless steel pot spoons
12	12 each	Stainless steel serving spoons
13	6 sets	Wooden spoons of different sizes
14	1 dozen sets	Spatulas
15	6 sets	5 pc stainless steel pot set
16	4 each	4 quart pressure cooker
17	2 dozen	Dishes
18	2 dozen	Plates
19	2 dozen	Cutlery items
20	1 or 2*	Refrigerator
21	3 each	Gas cookers
22	1 only	Electric cooker
23	2 each	Toasters
24	2 each	Toaster ovens
25	2 each	Bread makers
26	2 each	Microwave ovens
27	1 only	Juicer
28	2 each	Citrus juicer
29	6 each	Choppers *(small)
30	4 each	10-speed blenders

* According to the size of the school population

Textile Technology

Item No	Quantity	Description
31	10	8" fabric shear (bent handled and 2 left handed)
32	20	All-purpose scissors (all stainless steel blades)
33	20	Thread clipper (all stainless steel blades)
34	8	Embroidery scissors (all stainless steel blades)
35	20	Seam ripper (stainless steel)
36	8	Awl (stainless steel)
37	8	Bodkin (stainless steel)
38	8	Press mitt
39	10 packages	Hand sewing needles (assorted sizes)
40	10 packages	Machine needles (assorted sizes for machine listed)
41	40	Measuring tapes (flexible and calibrated)
42	20	Hip curves (stainless steel)
43	20	L-Square (stainless steel)
44	20	Metre stick (stainless steel)
45	2	Sleeve board
46	8	Fastener pliers
47	20	Rotary cutter/tracing wheel (straight-edge and serrated blade)
48	8	Pinking and scallop shears with stainless steel blades
49	20	Cutting knife (replaceable blades in snap-off section)
50	20	Thimble (stainless steel)
51	20	Pin cushion
52	8	Pin magnet
53	2 boxes	Tailor's chalk (assorted colours)
54	10 packages	Chalk pencil (assorted colours)
55	10	Bias tape makers, folding strips to form tape
56	8 sets	Fastener pliers with snaps
57	10 boxes	Straight pins
58	10 packages	Safety pins
59	2 dozen	Paint brushes (assorted sizes)
60	20	Glue gun and glue sticks (clear and coloured)
61	6	Wire cutting pliers (metal with rubber handles)
62	10 boxes	T-pins (stainless steel)
63	2	Straight stitch domestic sewing machine with all accessories
64	2	Multi-stitch domestic sewing machine with all accessories
65	1	Computerized Sewing machine, domestic with all accessories
66	1	Over lock Machine or Serger, domestic machine, four thread all attachments
67	2	Steam iron
68	2	Dry iron with professional heatproof base plate
69	2	Ironing board, leg slides under board to adjust height
70	1	Computer
71	1	Printer
72	1	Scanner

Traditional, New, and Emerging Materials and Processes

Item No	Quantity	Description
73	15	7 oz claw hammer
74	5	Hand saw
75	5 sets	Screwdriver set
76	6	Metric steel meter rulers
77	6	6" long nose pliers
78	6	6" slip joint pliers
79	6	6" multi-purpose pliers
80	6	9" diagonal cutting pliers
81	6	Vice grip pliers
82	12	Electric glue guns
83	6	Utility knives with replacement blades
84	1	Styrofoam cutter
85	6	Tape measure
86		Rubber mallets
87		12 oz wood mallet
88		Drill bit set, Jack plane
89		10" tubular hacksaw
90		Pop rivet tool kit
91		Files with handles (round, single, medium)
92		Punch and chisel set (wood)
93		1", 2", 3" and 6" C-clamps
94		Pencil compasses
95		6" Outside caliper
96		6" Inside caliper
97		8 oz Ball pein hammers
98		16 oz Ball pein hammers
99		Tubing cutter
100		Woodworking vices
101		Steel square
102		Rolling pin
103		Paint brushes
104		Oven/kiln
105		Clay knife or cutter
106		Pottery knife
107		Trowel (various sizes)
108	1	12" Disc sander (table model)
109	1	Wood lathe (table model)
110	1	12" Bench band saw (table model)
111	1	12" Bench drill (table model)
112	1	Tension saw (table model)
113	1	Scroll Saw (Table model) Portable
114	1	6" Jointer/planer
115	1	8" Bench grinder
116	1	7¼" portable circular saw
117		Fractional drill set (17 pieces); high speed with bit set
118	12	Computer* with software—Microsoft Office Word, Excel, Publisher, PowerPoint
119	1	Printer
120	1	Blender

* Internet access must be available to students

Appendix D

**Essential Resources for Conducting the Energy and the Built Environment
Component of the Technology Education Curriculum
(Based on a Class Size of 35 Students)**

Item No	Quantity	Description
1	12 each	"C" clamps
2	20 each	½ " paint brushes
3	2 each	Staple gun and staples
4	10 each	Magnifying glass
5	1 box	Mirror
6	1 only	Styrofoam cutter
7	20 each	Glue gun and glue sticks
8	12 each	Soldering gun (electric)
9	10 each	Hacksaw
10	20 each	Utility knives
11	8 each	Tape measure
12	20 each	9 V batteries
13	2 each	Measuring gauge (1 litre)
14	2 each	Metric & Standard hex keys (set of 9)
15	10 each	Rulers
16	8 each	Screwdriver set
17	8 each	Claw hammer
18	5 each	Solar cells (½ amp 6 V)
19	1 pack	Set of pulleys (various sizes)
20	6 each	Digital micrometers
21	6 each	Digital probe thermometers
22	2 each	Small gasoline engines
23	10 boxes	Small DC motors (6 V)
24	1 only	Box Fan (electric)
25	1 only	Bridge tester
26	1 only	Air compressor; 2 phase power; 5 gallon tank (120 V)
27	4 each	Multi-purpose miter box (plastic)
28	1 only	Motor generator kits (includes motor, generator, coupling, battery holder, connector, bulb, sockets and base)
29	1 only	Multimedia projector
30	1 only	Bench grinder

Appendix E

Essential Resources for Conducting the Biological Technologies Component of the Technology Education Curriculum
(Based on a Class Size of 35 Students)

Item No	Quantity	Description
1	1	Sterilizing units
2	1	Plastic heat sealer
3	1	Vacuum sealer
4	2	Plant tissue testing kit (macro elements)
5	1	Multi-tier, automated plant growing system equipped with hydroponics, irrigation, and fertigation system
6	12	Hand-held magnifying glass x 5
7	2	Dehydrator
8	6	Two-station digital water timer
9	12	Hand shovel
10	12	Hand fork
11	6	Watering can with fine rose
12	3	Pneumatic spray can
13	12	Spray bottles
14	6	Heavy-duty plastic buckets
15	12	Plastic measuring cylinders (10 ml, 25 ml, 100 ml)
16	12	Plastic measuring spoons (1/4 tsp – 1 tbsp)
17	3 cubic metres	Sharp sand
18	3 bales	Promix potting media (4 cu ft bales)
19	2 lengths	1" x 8" x 10' termite treated board
20	2	10 gal glass aquarium on metal stand
21	6	Earth pot (complete with potting media)
22	5 kg	Epson salt
23	45 kg	Agricultural limestone
24	45 kg	Mixed fertilizer 12:12:17:2 (NPK)
25	25 kg	Calcium nitrate fertilizer
26	5 kg	Foliar fertilizer (e.g., Nutrex, phosphogen)
27	45 kg	Nitrogenous fertilizer (e.g., Urea)
28		Fungicides
29		Insecticides
30	1 roll	Plastic plant labels
31	1	25 gallon plastic fish tank
32	30 metres	¼" plastic tubings
33	5 lengths	½" PVC pipes and fittings
34	2	Air filter
35	2	Biomass filter
36	2	pH meter
37	2	Aquarium pump
38	2 bags	Coloured stones
39	2	Fish nets
40	2	Measuring tape
41	1	5 kg capacity weighing scale

Item No	Quantity	Description
42	3	Salt block
43	3	Heavy-duty shovel
44	3	Heavy-duty hay-fork
45	3	Cutlass
46	12	Utility knife
47	12	Shears
48	12	Secateur
49		Acrylic paints
50		Puff paints
51	12	Hacksaw
52	12	Glue gun
53	12 doz	Glue sticks
54	500 ml	Contact cement
55		Glitter dust
56	3	Stencils
57		Coloured beads
58		Coloured stones
59	2	Dry flower press
60	12	Scissors
61		Fabrics
62	6 rolls	Floral wire
63	12 rolls	Floral tape
64		Moulding clay
65		Potter's clay
66		Garden ornaments (e.g., birds, butterfly)
67	2	1/40 HP water pump
68	2	Battery operated hand drill
69	2	Electric jig saw
70	12	6" plastic pot with saucers
71	12	8" plastic pots with saucers
72	12	12" plastic pot with saucers
73	12	12" plastic hanging baskets
74	12	12" hanging wire baskets
75	2 tubes	Silicone glue
76	12	3" Rooter pots for air layering
77	12	8" Aqua spikes
78	6 rolls	Bird scare holographic tape
79	2	Rafractometer
80	2	Soil moisture meter
81	12	Tweezers
82	12 bunches	Safety pins
83	6	Clinical thermometer
84	12	6" scissors
85	12	Flashlight
86	1	Laminator
87	12 rolls	Sterile gauze
88	12 rolls	Adhesive tape
89	12 rolls	Adhesive bandages
90	12	Elastic bandages
91	12	Crepe roller bandages
92	12	Triangular bandages
93	12	Sterile eye pad

Item No	Quantity	Description
94	12 pks	Antiseptic wipes
95	6 tubes	Antibiotic cream
96	6 bottles	Antiseptic solution (e.g., hydrogen peroxide, Savlon)
97	6 tubes	Hydrocortisone cream (1%)
98	12 pks	Painkillers (Acetaminophen, Ibuprofen)
99	2	Mouthpiece for CPR
101	12 rolls	Cotton wool,
102	12	Disposal Instant cold packs
103	6 bottles	Calamine lotion
104	6 pks	Alcohol wipes (or Ethyl Alcohol)
105	6 tubes	Burn cream
106	6	Plastic containers with trays
107	3 sheets	Adhesive plastic sheets
108		Paints
109	3	Mortar and pestle
110	2	Blender
111	6 bottles	Food colouring
112	6 bottles	Perfumes/scented oils
113	12	Dropper
114	2	Digital blood pressure meter
115	2	Stethoscope
116	2	Bathroom scale
117	1	Exercise machine
118	12	250 ml glass beaker
119	1	2 litre yogurt maker
120	1	Electric hot plate
121	6	2 litre glass bowl and lid
122	1	12 cu ft refrigerator
123		Tissue culture plantlets (e.g., banana, orchids, anthurium)
124	6	Hardening frame
125		Household bleach
126	12	Scalpel
127	12	Seedling trays
128	12	250 ml volumetric flask
129	6 bottles	Formula 1 (biological control bacteria)
130	12 pairs	Nitrile rubber gloves
131	2	1/40 HP Submersible water pump
132	2	Full-face chemical respirator with filter
133	2 packs	Dust mask
134	2	110 V electrical timer
135	6	PVC cutter
136	2	4" electric hand grinder
137	1 set	Screwdriver set
138	6	Claw hammer
139	3	50 feet electrical extension cord with duplex plug
140	6	8" pliers
141	6	12" crescent wrench