

The Technological Educator: A Hidden Resource

Overview

To be successful in the 21st century, students need to develop and master certain competencies. These are known as the 6C's or 21st Century Competencies:

- Character
- Citizenship
- Communications
- Critical Thinking and Problem Solving
- Collaboration
- Creativity and Imagination

These are best learned by a combination of theory and application related to “Real-World” issues and delivered using differentiated techniques. Technological educators are ideally situated for this as they have the experience, and they usually learned and developed their skills in the same manner. Most teachers outside of the technological education realm do not have full-time work experience prior to teaching in the classroom. However, to become a certified technological educator in the Province of Ontario, a candidate must have documented work experience. Most candidates, due to their level of training and industry experience, far exceed the minimum requirements as outlined by the Education Act and the Ontario College of Teachers. (Candidates must have a total of five years’ work experience in the area in which they want to teach. ***This does not include teaching experience.***) Throughout the province, our technological educators come from a variety of industry sectors and occupations (e.g. Health Care – medical nurses and technicians, Communications – graphic artists and television production personnel, Service – chefs and hairstylists, Manufacturing – various trades and professional engineers, Transportation – automotive and aviation mechanics). Along with this, several technological educators have additional certifications in the form of degrees: History, English, and Master’s level.

21st Century Teaching and Competencies

How the technological educator addresses the competencies will vary from school to school and educator to educator. Before going on, it is essential to understand the basic function of the technological education classroom, which utilizes a combination of theory and practical (hands-on) activities to deliver the learning. Not everyone will attain the same level of knowledge and skill development, although “Mastery Learning” is the goal. Techniques and strategies such as differentiated delivery are utilized. Growth, critical thinking, and problem solving are components of every activity and lesson; students are not left “to figure it out,” as safety is a concern. From the Curriculum:

Technological innovation influences all areas of life, from the daily lives of individuals to the work of business and government, to interactions on a global scale. It helps meet basic human needs and provides tools for improving people’s lives and exploring new frontiers.

Pg 5 grade 11-12 Technological Education Curriculum document, MOE 2009 revised

The fundamental purpose of the technological education program is to provide students with knowledge, skills, and attitudes that will enhance their ability to achieve success in secondary school, the workplace, postsecondary education or training, and daily life.

Pg 6 grade 11-12 Technological Education Curriculum document, MOE 2009 revised

Teachers also support students in developing the reading, writing, oral communication, and numeracy skills needed for success in their courses. Teachers bring enthusiasm and varied teaching and assessment approaches to the classroom, addressing different student needs and ensuring sound learning opportunities for every student.

Pg 9 grade 11-12 Technological Education Curriculum document, MOE 2009 revised

Character

The concept of character incorporates attitudes, behaviours, values, temperaments, and mindsets (social and emotional), all of which help shape the personality of the student.

- As all technology educators come from the world of work, morality is a significant portion of their character.
- Technology educators naturally infuse their experiences into their teaching. They often relate to how they were treated, how customers were treated, and how people should be treated. (Golden Rule)
- They model desirable characteristics and are strong social justice supporters.

Citizenship

Citizenship involves the development of personal attributes such as self-regulation, empathy, and responsibility. These address political, ecological, social, and economic issues essential to living in a contemporary, connected, interdependent, and sustainable world.

- To be effective, technology educators must be informed. This means they take advantage of the Internet and other forms of media (e.g. online training sessions, research, current events, and news) and pass this outlook to the students.
- Technology educators discuss how their specialty impacts society and the environment locally, nationally, and globally (often as a casual current events conversation). Students need this perspective to be successful and engaged citizens.

Respect for all is key and is reflected and modeled daily.

Communications

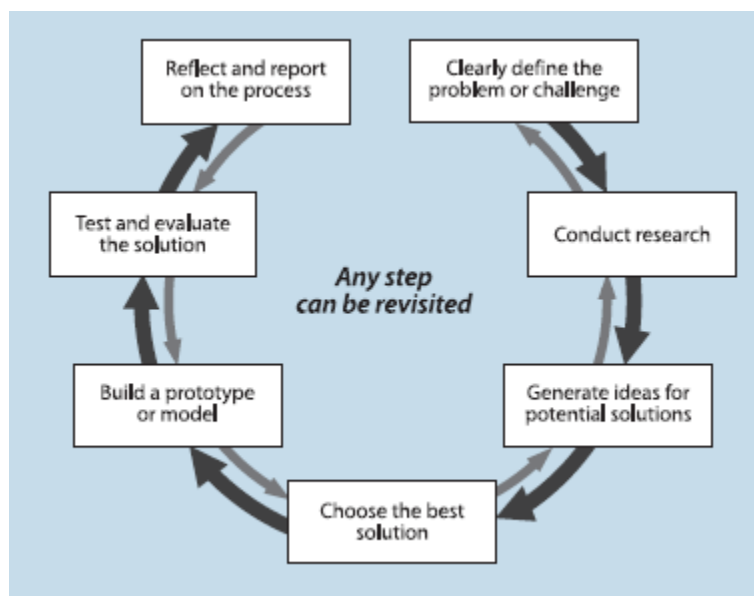
Communication in a 21st century context can be defined as the ability to transmit information effectively (orally, in writing, and with a variety of digital tools), and the ability to listen, understand and analyze.

- The level of literacy and numeracy is high in any technical field, and all technological educators had to achieve this standard before they became certified.
- Research skills are essential. Knowing how to find the answer is key.
- Group work (collaboration, brainstorming, student interaction) is emphasized.
- Technological educators use Differentiated Instruction techniques naturally as this is how they work and were taught.
- Technological educators provide continuous feedback; most reflect a mastery learning philosophy.
- Technological educators deliver curriculum through a combination of theoretical and practical (hands-on) lessons.

Critical Thinking and Problem Solving (Inquiry)

Critical thinking and problem solving is defined as the ability to design and manage projects, solve problems, and make effective decisions using a variety of tools and resources.

- This is the basis of any technological education program. The design process is a key feature: define the problem, conduct research, generate ideas and solutions, choose the most probable, build a prototype, test and evaluate the solution, revise as necessary, reflect and report results. All tasks and assignments have these elements incorporated.



Collaboration

Collaboration is defined as the ability to work in teams, learn from and contribute to the learning of others, use social networking skills, and demonstrate empathy in working with others. Collaboration also requires students to develop collective intelligence and to co-construct meaning, becoming creators of content as well as consumers.

- Collaboration is a hallmark for running technological education classes. Students do receive individual attention but are encouraged to collaborate (especially in group work and brainstorming) when performing tasks, both written and practical, and building products. Technological education classrooms should never be totally quiet even if the equipment is not operating.
- Technological educators often collaborate amongst themselves. This should be extended to the school, not confined to the tech area. For example, technological educators can train math teachers in activities that incorporate math in practical settings such as stair design (using angles and slope) or surveying (using trigonometry).

Creativity and Imagination

Creativity and Imagination is often defined as the pursuit of new ideas, concepts, or products that meet a need in the world. Innovation contains elements of creativity and is often described as the realization of a new idea in order to make a useful contribution.

- By nature of their training (e.g. incorporating the design process), technological educators use creativity and imagination to solve problems and create solutions. This skill and knowledge are passed along to the students and emphasized while they perform activities.

Technological Education and the Renewed Math Strategy (RMS)

The RMS calls for the delivery of math concepts using applied learning techniques coupled with immediate feedback. The technological educator is uniquely positioned to do this, as this style of math education is used daily in the form of “real-world” activities. Examples include the following:

- ***Algebraic calculations*** to determine required board footage of lumber
- ***Area*** to calculate coverage area of a wall, lawn, garden (e.g. how much material is required)
- ***Budgeting*** to estimate and finalize costs
- ***Geometric Angles*** to design and fabricate roof rafters
- ***Slope*** to lay out and construct a set of stairs
- ***Pythagorean Theorem*** to confirm squareness (3-4-5 triangle)

- **Trigonometry** to perform a physical survey
- **Ratio** to mix cement, create and use recipes, or mix and apply cosmetics
- **Volumes** to verify volume of fluids required in an automobile

Technological Education and STEM/STEAM

STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy. (Tsupros, 2009).

In STEM, the term “technology” refers to the use of **all** technology, not just computers. Recently, STEM was redefined as STEAM; the A was added for Arts, as Artistic Design is an essential component of innovation. STEM/STEAM has traditionally been associated with the natural pairing of Math, Science, and Technology, but the concept can be applied to any subject or discipline. STEM/STEAM education integrates concepts usually taught as separate subjects but emphasizes the connections and the application of skills and knowledge to real-life situations. This is the essence of technological education. The benefits of including technological educators in the development and delivery of STEM/STEAM include the following:

- **Cross-Curricular** – making subject connections for students through real-world activities and projects
- **Budgets** – reducing lessons/projects/activity costs by designing and building resources, sharing field trips, utilizing in-house expertise (the technological educator’s knowledge and experience), utilizing the community relations that technological educators bring (donation of materials, guest speakers)
- **Assessment and Evaluation** – using the skill to assess and evaluate applied practice, sharing the responsibility for developing grades
- **Differentiated Lesson Delivery** – adapting to the individual needs of students at all levels of ability

How Administration Can Assist

Administration at both the school and board level influences how learning takes place, and as a result, is well situated to encourage student and staff success:

- Get to know your technological educators and their backgrounds, the work environment, and the issues that surround these educators on a daily basis
- Urge your technological educators to share their talents with colleagues and their classes (e.g. careers, PD sessions, co-op, and assessment and evaluation of applied activities)

- Encourage other departments to develop cross-curricular activities with technological education (STEM/STEAM, e.g. fabrication of CO₂ cars, which combines science and math concepts)
- Develop a K-12 mindset that includes cross-panel collaboration (e.g. combined projects between secondary and elementary students to complete a task; visits by elementary schools to technological facilities; training and skill development for elementary teachers)
- Promote technological educators as a valuable resource (e.g. differentiated techniques, assessment and evaluation of applied activities, the use of feedback as a teaching strategy)
- Acknowledge the contributions of technological educators, especially taking on and working with students that others prefer not to teach (e.g. the “Dumping Ground” issue, not wanting to deal with students who have “discipline issues” or a low chance of success)

Final words

Technological education has many benefits for students, staff, and the community:

- Technological educators must have several years of industry training and experience before becoming teachers (real-world perspective, resource for co-op pre-placement assessment)
- Technological educators generally maintain industry contacts (potential co-op/job shadowing placements, possible guest speakers)
- Technological educators can provide relevant and practical input (e.g. cross-curricular activities, DI, how to teach using applied techniques, in-house guest speaker)
- Technological educators have the ability to work with people at various levels of skill and knowledge (high level of literacy and numeracy is necessary to function in a technical environment)
- Technological educators treat teaching as a true vocation since a deliberate and conscious decision was required to leave a career and enter a faculty of education
- Technological educators have a solid understanding of the workplace and college pathways (not all tech teachers are university grads)

The Ontario Council for Technology Education (OCTE) is a volunteer-non-profit subject association and our mission is:

Represent, support, and advocate for Technological Education K-12, Teachers and Students to ensure that the needs of the local, national, and global communities are reflected.

In support of this mission, OCTE is called upon regularly to provide input to the College of Teachers, Ministry of Education, Ministry of Labour, and faculties of education. Examples include:

- Highly Skilled Workforce
- Two-year pre-service programs (content, delivery models)
- Qualifications, AQ, and ABQ development
- Renewed Math Strategy (using applied techniques and assessment to deliver mathematic education)
- Safety and Inspections (content, resource development)
- Course development (content review and development to reflect current industry requirements)

Professional Development and Teacher Education

OCTE recognizes that professional development is key to staying current with Ministry of Education and Ministry of Labour initiatives. In support of this, OCTE delivers PD in the form of conferences and workshops relating to leadership, Pathways, innovative technology, safety, curriculum delivery (elementary and secondary), STEM, and Makerspace. These are beneficial to all teachers and administrators, not just technological educators.

OCTE members have also been called upon to provide input on many Ontario College of Teachers initiatives, including the following:

- Draft guidelines related to the Technological Education Additional Basic Qualification courses
- The role of the Superintendents
- Technological Education Emphasis Course – guideline writing
- Health & Safety
- Three-part Science & Technology qualification
- Teaching assignments (letters of permission and the ability to teach academic subjects, such as mathematics)
- PQP courses and the technology teacher (providing opportunities for technology teachers to progress into administration)

OCTE was present at every stage of the technology curriculum review, writing, and release. As the provincial voice for technology education, OCTE was asked to take a lead role in the development of the revised curriculum.

Professional Development does not happen in a vacuum. OCTE collaborates with many subject associations such as the Science Teacher's Association of Ontario (STAO) and the Ontario Association for Mathematics Education (OAME).

For further information on how OCTE can assist you, please contact us via our website www.octe.ca.