Secondary School, University, and Business/Industry Cooperation Yields Benefits to Technological Education Students

By Dr. Ann Marie Hill

Political Dimensions of School and Community Cooperation

The secondary school work environment of technological education teachers in Ontario has changed. These teachers cope with pressures from the Ontario Ministry of Education (OME), business and industry, and the public at large for increased community involvement in education and for relevant student learning that is connected to life outside of school. This is what Ruddick (1999) referred to as the pressured, political dimensions of partnerships. Many reports have portrayed this dimension of partnerships at the national level in Canada (Dave, 1976; Dryden, 1986; Human Resources Development Canada, 1994, 1995) and at the provincial level in Ontario (Premier's Council, 1994; Royal Commission on Learning, 1994a, 1994b, 1994c, 1994d).

In Ontario, a past policy document (Ontario Ministry of Education and Training [OMET], 1995) for secondary school technological education introduced the concept of partnership. One chapter, titled "The Learning Environment," consists of four subsections: the facility, resources, the role of the teacher, and process and project management. The latter subsection states:

> It is necessary for students to move to different areas in the school or out into the community in order to complete projects. The teacher will need to work in close co-operation with all stakeholders (students, parents, community members, other teachers, and administrators) to co-ordinate the contributions of all those participating in the students' activities and to address any concerns related to them. (p. 13)

The next chapter, titled "Considerations in Program Development," consists of seven subsections, one of which is school-community partnerships. This subsection argues:

> In order to maintain and strengthen their connections with the community, schools must involve community members and groups in its planning, delivery, and evaluation of all broad-based technology programs. Schools should consult with community representatives on a regular basis in order to identify new needs as they arise and allow programs to be adjusted accordingly. (p. 16)

A new policy document (OME, 2000) now replaces the 1995 document, but the idea of partnerships remains.

> In general, technological education programs should be designed to take advantage of local opportunities for students to combine work experiences with classroom learning. Programs may be modified to reflect community needs. In-class and out-of-class components must be carefully matched and monitored so that students' experiences are relevant and authentic. (p. 200)

Community-Based Projects in Secondary School Technological Education

Research in technological education (Hill, 1996, 1997, 1998, 1999) has documented that it is not solely the project that is important in project-based learning. While the project provides the environment for students' active engagement in their learning, the teacher alone frequently defines the project. The experience of making such projects may not be directly relevant, authentic, or meaningful to students' lives. Dewey (1977) stated: "It is not enough to insist upon the necessity of experience, nor even activity in experience. Everything depends upon the quality of experience" (p. 27). He described two aspects of quality: "There is an immediate aspect of agreeable or disagreeableness and there is its influence upon later experience" (p. 27).

Projects become more meaningful to students when the technological problem-solving experience is situated in and relevant to their lives, such as involving them in the community in which they live. A real-life context sets real human needs for projects and this in turn establishes relevant activities for authentic learning. The learning environment in this approach shifts from a situation of project-based learning, which is typically teacher conceived and of less interest or relevance to students, to community-based project learning, where students are involved in projects from their community, called community-based projects. The community is typically the immediate community serviced by the school, but it can expand beyond local geography. Community partners can be business or industry-large or small—which are located in the community, local families, the school itself, or the school board. Students design projects for community partners, and the community partners provide resources and expertise to students.

A community-based project approach to learning allows students to meet real human needs in their technological education courses; they carry out technological design for an identified need of a community member. Such projects encourage working cooperatively with people inside and outside of school. As students meet with their community partners and with experts in the community, they recognize other people as important learning resources. They also become motivated and engaged in their own learning. Programs that reach out to the world outside of school provide a means for relevant student learning and a stimulating and viable educational experience for students. The gap between school and life outside of school is also reduced as students see applications for what is learned in school and are presented with a new range of choices and opportunities from these community experiences.

Community-Based Projects Applied in a Manufacturing Technology Program

Hill and Smith (1998) examined a secondary school in southeastern Ontario where graduates and others familiar with the setting spoke highly about a particular program and the teacher who had received national recognition and teaching awards for his work in the school. The teacher's program in technological education consisted of courses in Manufacturing Technology, Grades 9 through 12. One Grade 10 class and one Grade 11 class were studied intensively during a five-month period.

The Curriculum

The curriculum content for both Manufacturing Technology courses, Grade 10 and Grade 11, included: the technological design process, interpreted as a problem solving process; mechanics (stress and strain, strength of materials, gears, pulleys and belts); power systems (electrical, pneumatic, hydraulic); control theory; skills building using tools and equipment (including computers); and group work. There were also different community projects ongoing simultaneously in any one course as students worked in groups with different community partners.

Community-based projects during the year of the research ranged from bike cars, a bike trailor, and classroom objects for teaching technology at local elementary schools to projects with local business and industry. A gardening table and a laundry bin device were created for a local retirement home, and a spool rewind system prototype was created as part of the production process of a large multinational tire producer.

The Teacher

The teacher had worked as an engineer in a large multinational firm and had changed careers to become a teacher. He had begun his teaching career teaching physics and mathematics and after several years became a technological education teacher. His main reason for the change was that the pedagogy used in technological education courses "fit" with his philosophy of teaching. In an interview, the teacher described the impact that the change in subject area assignment had had on him, and his adoption of a project-based approach to teaching that included community involvement:

> I started teaching in the conventional manner. I was at the front of the class, you know, going away at a bunch of people sitting in front of me, and...my sense of what I got back was that people weren't learning. True, they were able to regurgitate, but that's not learning. They weren't learning. It wasn't registering....The material was fine, but somehow it just didn't have a context, and I was beginning to think about ways, at that point, about how to make it relevant to the kids....I think the context is really the important thing....You know, just teaching the physics or a mechanics principle in pictures doesn't compare to somebody going and picking up something, pulling on it, and then by drawing a little sketch...just having that tangible holding-on contact makes all the difference to me. And so it grew there. I started thinking, well if that's the case, why don't we try building something, and [I] began a long process of learning how to do that. (DH,[1] personal communication, March 13, 1996)

He described "learning in context" as "being able to put together the doing something and the understanding of doing something." His example of what he meant was based on life experience. "I was doing physics problems with my daughter...after doing a bunch of problems on paper, little pictures—I asked her 'What's that for?' and she didn't have any idea...that's why I say...it's not understanding...it didn't have connection to the kids' lives" (DH, personal communication, March 13, 1996). His life experience had led him to technological education where he involved the community in student projects in order to create a learning environment where students could learn in a context that was connected to their lives.

The Students

The students in these two classes were both male and female with a wide range of interests and abilities. The Grade 10 Manufacturing Technology class consisted of 14 students: 12 male and 2 female. Grades on completed courses toward an Ontario secondary school diploma (OSSD), across all subjects, ranged from 51% to 95% for the males and 78% to 96% for the females. The students' age varied from 16 to 19 years. There were 19 students enrolled in the Grade 11 class: 14 male and 5 female. Their grades on completed courses toward an OSSD ranged from 23% to 97% for the males and 62% to 100% for the females. This group had completed more OSSD courses. As well, their age range was more uniform ranging from 17 to 18 years. Student interviews from both grades revealed that students enrolled in the course for a variety of reasons: from gainful employment directly related to the technological education course to continuing on to university engineering programs.

Benefits of Community-Based Projects to Secondary School Students

Community partners, the school principal, and students all commented on the benefits of school and community cooperation in the delivery of technological education at the secondary school level.

Community Partners' Perspectives

There were many community partners associated with the Manufacturing Technology courses. Data from one large-sized company and one medium-sized company are reported below. Both reveal similar perspectives about the knowledge, skills, and values deemed important for high school students and how partnerships assist students to close the gap between school and life beyond school.

Large-sized company. A major international tire producer had worked with the secondary school for several years. Company contact people assigned to work with the school were selected for their technical abilities associated with class projects. One assigned contact person described his role in the cooperative project for that year: "I present them with the problem and allow them to come up with their own ideas without telling them what I think is the solution" (SD, personal communication, March 22, 1996).

Initially he described the skills, knowledge, and attitudes needed by students graduating from high school in terms of generic skills such as the ability to be flexible, solve problems, deal with any situation effectively and in a timely

[1] For purposes of anonymity in this qualitative study, pseudonyms in the form of initials were assigned to represent real names.

manner, continually adapt and learn, and work with other people on a team. He stated that specific skills were best learned in the workplace. "I think that technique and the ability to do, that is more what they learn [in the workplace]" (SD, personal communication, March 22, 1996).

When asked to explain why specific skills should be learned "on the job," he provided more detail. "The need for specific skills… is going to be really dependent on where you're trying to place them in the company." He explained that if an employee were hired as a welder or an electrician, he would hire "somebody who has some sort of detailed [skills] background." As such, the company would expect the applicant to bring these skills to the job. However, when an applicant was hired to work in production, the company provided specific training. "If you're talking about a lot of our production jobs, the skills that are involved are not things that you would normally learn from an educational institution," because the skills required were specific to that company's production process. When he described qualities of applicants who were hired to design and implement company projects, he said, "Then in my opinion you're looking more at a problem solver who works with other people" (SD, personal communication, March 22, 1996).

He cautioned against only specific skills training in secondary school. Instead, he described the role of secondary school technological education courses in terms of generic skills. "So the most important thing in my opinion wouldn't be learning a particular function or craft or whatever. It would be becoming generally knowledgeable and flexible, to be able to adapt, to learn" (SD, personal communication, March 22, 1996).

In discussion about students obtaining specific technical abilities while participating in community-based course projects, he recognized the importance of technical skills to make the artifact and generic skills to work in a group and move through the design process. He also recognized the value of creativity in these projects and the confidence that such a process instilled in students. "It's the getting there and the learning it...and getting the confidence of, 'Hey, I can do this! I can do more!', that attitude" (SD, personal communication, March 22, 1996).

Clearly, it was not only the acquisition and refinement of generic skills that moved student projects to completion. Knowledge and skills from many different technical areas were required for project completion. This large company also required, for certain jobs, skilled and technical employees, but even these individuals needed generic skills as well.

Medium-sized company. Interviews with the contact person from one medium-sized company, a retirement home, also revealed a need for generic skills in the workplace. This work environment used a different model for teamwork. First, all employees were part of a team. Second, the teams were comprised of people with different skilled backgrounds who worked together for a common goal—"to maintain the quality of life" for each elderly resident. "All our teams are composed of maintenance, housekeeping, health care aides, psychologists, right up to the administration. Every committee has those people on it" (LA, personal communication, March 22, 1996).

The contact person for this care agency described that while she brought to the team a skill, she was also required to move beyond a narrow job description when needed and to change her skills as the job evolved. She described job requirements as flexible ("My job here is housekeeping...but I also do other things...the cleaning staff [are] very involved with the residents...with the residents' care—emotional care"; LA, personal communication, March 22, 1996) and as requiring on-going education ("We have to attend care conferences.... Your job is not always what it appears to be"; LA, personal communication, March 22, 1996). She saw her role as sharing this with students, as well as providing them with project possibilities to better the life of the residents.

The School Principal

The principal was very supportive of all students' life goals. He believed in making school relevant so students' secondary school education would be meaningful to them. When talking about the qualities important for graduates, the school principal saw three important areas of an adolescent's development: personal qualities, general qualities, and specific skills. Personal skills were described as a sense of responsibility, recognition of the importance of learning, and honesty. General skills were described in terms of literacy, numeracy, science literacy, technical literacy, computer literacy, and data processing.

He talked about specific skills in the context of students in their senior high school years and students moving toward employment. Here, he pointed out the necessity and importance of specific skills. "If you've got two students going for a job in autobody...they both have the personal skills that allow them to function in the workplace. Who is that employer going to hire?....Well, my experience tells me they are going to hire someone with specific skills" (MD, personal communication, March 3, 1996). The principal recognized that school-community partnerships provided benefits to students. They provided relevant learning opportunities for students and helped close the gap between school and life beyond school.

Students

Both Grade 10 and Grade 11 students appreciated their Manufacturing Technology courses for the relevance the courses brought to their learning. The teacher's reasons for engaging in this approach to teaching were qualified by what students said.

Grade 10 students talked about the benefits of community-based projects in their course. Their comments revealed that the course affected their learning in other subjects and their overall secondary school experience. They used words related to not boring ("constantly do different things," "moving around," "not formal," "you don't actually realize that you're learning") when talking about the course. They indicated that in learning by doing, the course was like real life and that the theory and practice combination made their learning more challenging. Community-based projects were described as providing varied, not narrow, experiences and that the combination of theory and practice afforded in community-based projects made learning relevant. "It gives you like, you know how school is. School, and then you want to grow up, and leave, do other stuff that has nothing to do with school. Both together, you don't feel like you are doing it for no reason. Like most schooling is" (SA, personal communication, December 5, 1995).

Grade 11 students revealed similar benefits of community-based projects in their course. As well, they were cognizant of the social benefits of community-based projects. "If we didn't do it, then a lot of things wouldn't get done [in the community]" (HI, personal communication, November 17, 1995). "It's profitable for both people. They [the community] get something that they can use, that they need, and we get the experience of building it, of working on it for an entire semester" (JE, personal communication, November 17, 1995). They also appreciated the challenges that this course offered them and they were aware of how it contributed to their plans for life beyond school.

These courses benefited students in more ways than just narrow skill acquisition. Problem solving, decision making, creativity, teamwork, social responsibility, trust, and continuous improvement and learning were evident in the community-based projects.

Impact of Community-Based Projects on Teachers

Course delivery through cooperation between secondary schools and the community has a direct impact on the day-to-day life of teachers. Hill and Hopkins (1999) wrote that from the teacher's perspective, it is feasible to use community-based projects in secondary school settings. One important factor is simply to get started by establishing links with the community. Once this first step is complete, additional opportunities arise by word of mouth.

Structurally, there is very little change to a school day with this approach. There is the same number of classes per day and teachers still have to prepare for their classes. What changes is how teachers go about their teacher lives. Each day, each class, each period is never the same, never repetitive. Students' needs and activities are never entirely predictable. However, the curriculum is predictable. Course content guides the course, but activities used to learn the content are not as predictable. At the onset of a course, the teacher spends a substantial amount of time thinking about how to match course content to community projects. Once projects are selected, the teacher must carefully schedule student acquisition of content to advance student projects.

The classroom setting also changes with this mode of delivery. There is a need for a technology laboratory or "shop" area, whether within or separate from the classroom. In addition, the teacher's workplace moves beyond only the school and classroom/laboratory setting into the community. Community members both attend class and are part of the course. Also, students and teachers go to community settings. Human and nonhuman community resources of all kinds are sought out and used. Thus, teachers relinquish a more authoritative role in their classrooms for the role of facilitator.

The teacher's role changes significantly in this model from the conventional transmitter of knowledge to the facilitator of learning. The purpose for student learning is not because the teacher wants students to learn something, but because students need to learn to advance their community-based projects. The focus of class time is on the learner. The learning environment becomes more interesting for students and challenging for the teacher. The challenge is to develop the confidence to be a risk taker and to go beyond the boundaries of convention.

However, this pedagogical approach does not come without added pressures for teachers. There is pressure to succeed on various levels. Projects must successfully meet community needs and be completed within a negotiated time frame, typically by the end of a semester or at least by the end of the school year in the case of larger projects. The teacher takes on personal responsibility for successful completion of projects. The teacher's reputation and the program's livelihood rest on the teacher's ability to manage such a program. There are also day-to-day pressures that arise from teaching courses where students work on different projects. Attention to detail in the beginning weeks of school is paramount, as evidenced in the following excerpt from the Manufacturing Technology teacher's audiotape journal: "Getting these things set up and organized is probably the most important thing you can do; getting a proper definition of what the technology project is, getting a good relationship with the clients...getting the kids to understand the size and definition of the project" (DH, personal communication, September 6, 1995).

But this teacher believed that a community-based project approach was well worth the effort on his part. Experience had shown him that many students do not learn well in a traditional teacher-centered classroom. He still used more traditional approaches to teaching, for example, a 10-minute lesson at the beginning of class or a small teacher-focused project for content not covered through community-based projects. However, this represented teaching moments within the activities of the community-based projects, not a main pedagogical approach.

After several years of examining the community-based project approach in technological education courses, new teacher organizational skills and knowledge have emerged, including the ability of the teacher to:

- Have faith in students' abilities to learn. Relax in being a facilitator.
- Teach a short lesson of about 10 minutes at the beginning of every 70 minute class, and then trust and manage.
- Rearrange expectations of the teacher and students, for example:
  - Don't spend too much time with one group, one project.
  - Give students encouragement and clues, and then move to another group.
  - Encourage students to ask the teacher for help when needed.
  - Inform students that if they are waiting for teacher help, or for the community partner visit, etc., they should be doing some other activity while waiting.
  - If students need materials, they are responsible to make a list and give it to the teacher.
  - Inform students they are also responsible for their learning.
- Accept that they do not know everything, that they are not the purveyors of all knowledge for all projects. Students are responsible for their learning also. Then the teacher can focus on managing students' learning and projects.
- Be enthusiastic and energetic.
- Be an on-going learner.
- Use human and resource materials in the world outside of school.

Community-Based Projects and Teacher Education

Teacher education programs can model secondary school classrooms that link with the community. Remembering that artifacts, systems, and processes are supposed to meet human needs, in teacher education courses, teacher candidates would be required to find projects based on community needs. In doing so, they would experience the technological problem-solving process that they in turn would expect their secondary school students to engage. The community can be inside or outside of the class.

The teacher education program at Queen's University, Ontario, engages teacher candidates in both teacher-directed and community-based projects. In 1995-1996, examples of community-based projects to meet needs outside of the teacher education class were "The Emergency First Aid Backpack," a specially designed backpack to carry emergency supplies and equipment to remote locations; the "Exit Buddy," a device that enables firefighters to quickly locate exits in dark, smoke-filled rooms; "Uropia," a lightweight, portable rope course; "The Art Kart Centre," a space organizing system for elementary school classrooms; and a "Support Table" for last year's project, the "Arm Rehabilitator 2000." Projects that met in-class needs were a "Multimedia Interactive CD," an information program designed for the World Wide Web about Queen's University's technological education program; and an "Information Video on Broad-Based Technology" to introduce high school students, staff, and the local community to the study of technology in secondary schools.

In 1994-1995, examples of community-based projects were the "Arm Rehabilitator 2000," designed for stroke patient therapy at Saint Mary's of the Lake Hospital (Gubbels, 1995), and the "Environmobile 2000," a solar-charged battery land vehicle made from old bicycles and an old chair. The former met an outside community need while the latter met an inside (class) community need. In 1993-1994, projects included an "Equestri-Lift" for physically challenged equestrian riders and a "Wind Powered Generator."

As teacher candidates move through their community-based projects, discussion focuses on the transfer of their university experience into secondary school classrooms. They begin to think through what it means to act as facilitators. They begin to understand the connection between the notion of facilitator, the negotiation of meaningful student projects, and alternative ways to deliver course content (see Boomer, 1990). In the latter, the critical teacher skill is to be able to plan student learning of skills and knowledge to allow students to advance their community-based projects. Teacher candidates also discuss ways to weave values and human and environmental concerns into classroom talk and to provide a learning environment for secondary school technological education students that fosters creativity, exploration, critical thinking, and connections to what is learned in other school subjects and to life beyond school.

Conclusion

Research about school and community cooperation to deliver technological education programs at both secondary school and teacher education levels in Ontario, Canada, has documented that such collaborative classroom practice is not only possible in technological education, but is highly desirable because many modern theories of learning are seen in this educational practice (Hill & Smith, 1998). Collaboration between schools and community partners augments both secondary and university student learning and allows business and industry to give something back to the community from which they benefit.

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Notes

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