Chapter 4
The STEM Project Team as a Student-Developed Learning Environment:
The Urgent Need for Teamwork Capability in the 21st Century Economy

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ABSTRACT

Global competitiveness based on technological innovation has led to an increasing emphasis in education systems at all levels of the STEM fields – learning the content and methods of science, technology, engineering, and mathematics. The assumption seems to be that competitive advantage in business and industry is based on employee mastery of STEM knowledge for innovation. However, educators seem to be missing the importance of the immediate work team environment as the context of innovative thinking and of the competencies making that possible through learning, collaboration, communication, and creativity. This chapter builds a case for educators to deliberately work at developing those competencies at the team level throughout all levels of the education system. Teamwork leverages the knowledge and skill of team members for innovating to solve complex problems.

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INTRODUCTION

This chapter builds a case for deliberately teaching students team skills like those used by their parents in the workplace, for three reasons: provide them with the ability to manage their own classroom learning environment, develop skills that will be used in project work at later levels of education, and prepare them for smoother transition into the work force. At work, collaborative effort has appeared in both formal and informal structures ranging from permanent to temporary work teams to focused or loosely structured communities of practice. These structures facilitate interaction that allows for sharing and generating of knowledge. The related competencies for success in the workplace have been changing. Spitzer (2007), illustrates the importance of people with knowledge in the system, "While an organization's 'data' resides in its computer systems, its 'intelligence' is found in its social system" (p. 255).

The world of work has changed in the past few decades, creating the need for employees with different skills and attitudes and with it education has changed (Ouye, 2011). The shift from rote learning to active involvement and inquiry, particularly in small groups, has provided students with a learning enhancing environment for working on mastery of content from preschool through graduate school (K-20). Still, the challenge of conveying the growing body of fundamental content knowledge to students that prepares them to be effective contributors in the work place exceeds the capacity of the classroom teacher in many settings. Perhaps, an overlooked resource for creating mini-learning environments conducive to enhanced understanding by students is the small project group. As widely as those groups are used in project-based or problem-based assignments, particularly with science, technology, engineering, and mathematics (STEM) content, little attention seems to have been paid to how the students themselves can influence those learning environments.

At the turn of the last century, employees were viewed as parts in a machine and as easily replaceable. The bottom level of the organizational hierarchy was given the message, "check your brain at the door." Work was designed to be as mindless as possible. The methods that Fredrick Taylor created to guide Henry Ford's management of assembly lines 100 years ago called Scientific Management because of the emphasis on measurement have diminished in value, taking a back seat to more recent methods, even in some workplaces in developing and emerging economies (Kanigel, 2005). Globalization has increased competition that pushes organizations to invent better ways of utilizing the capabilities of employees. Evolution of technology has both enabled and driven changes in ways of organizing, including the shift to team-based work and virtual team work where the members are scattered geographically.

In a parallel shift, the understanding of the knowledge-employee relationship has shifted and continues to shift. Knowledge and information were treated as synonyms in the workplace and perhaps in the classroom. As the knowledge era has matured, scholars and practitioners have recognized that knowledge is critically different from information. The latter is also referred to as explicit knowledge rather than tacit, and as knowing what rather than knowing how, declarative knowledge rather than procedural. (Powell & Swart, 2005; Taylor, 2007; Tims, Bakker, Derks, & van Rhenen, 2013). Knowledge (tacit knowledge or knowing how) is the property of the individual. It is generated when the employee applies information in a specific context and has been called actionable knowledge. Explicit knowledge can be captured in written materials and computers. Tacit knowledge remains the private property of the individual, so human capital forms the basis for intellectual capital. Ployhart and Moliterno (2011) define HC as emergence of the set of knowledge, skills, abilities, or other characteristics (KSAOs) of the individual that are transformed through the processes of the work unit. Because of baby boomer retirements, outsourcing of knowledge work jobs, and decreased participation of women in the workforce in