What is P-20 and its Relationship to Engineering Technology?

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Abstract
The P-20 program encompasses P-16, postsecondary education and further includes business and community learning requirements. P-20 has been an evolutionary movement which was first K-16, then P-16 and finally the term P-20 which included graduate schools. The current P-20 environment includes the previously defined areas and expands into lifelong learning, including business and community organizations. P-20 educational and economic opportunities, including financial requirements, are explored. The paper reviews the definition of P-20 and how P-20 supports Engineering Technology. Supporting information illustrates the program values and beliefs for P-20 leaders. P-20 leaders must be innovators, exploring creative solutions to resolve educational issues and problems. The role of innovation in education and the importance of the development of new teaching methods and solutions are examined. The successful P-20 leader must implement ideas and new methods. The importance of successful innovation implementation is researched. Leadership development is important to the P-20 student, and the requirements of leadership are explained. Diversity and the requirements for understanding the many conditions of diversity are explored and summarized. An understanding of how P-20 helps to coordinate the efforts of funding, programming and aligning the efforts of P-16, including postsecondary education and having participation from the workforce and organizations is presented.

Introduction
Engineering technology students comprise a broad role of occupations and roles which require different skills and interests. Often, the engineering technologist is called upon to utilize engineering technology skills that overlap many disciplines. The technologist also called upon to lead, and in many instances, the skilled technologist is asked to lead change in an organization. The P-20 movement is working to pull education, community leadership, government, and industry together. Engineering technologists will find it essential have an introductory awareness of the future directions of P-20.

The Importance of P-20 to Engineering Technology

The engineering technology programs at universities often have a strong relationship with local industry partners. This relationship often affects changes in programs and course structure that is provided at the local higher educational institutions. Whether the program is a two year or four-year program, the faculty and administrators are in touch with their industry partners. Barriers, walls, protection of turf and silos must be removed so that forward progress in the education process can be made (Canole & Young, 2012). The partial removal of silos and barriers in the exchange of information, if not completely removed, has occurred within the engineering technology field through collaborative efforts with industry partners.

In programs in science, technology, engineering, and mathematics (STEM), engineering technology has been a leader in communication with industry and education partners. The
communication and integration of engineering technology with the education and industry partners result in engineering technology being a leader in the P-20 education process. P-20 is the paradigm that education is utilizing to unite life long learning, P-16, higher education, and industry. The lifelong learning aspect encompasses the birth to death within education that engineering technologists often associate with the cradle to grave product development cycle.

**Discussion**

This paper provides an explanation of P-20 so that engineering technologists can be aware of the term and work to understand their role within P-20. The importance of P-20 to the engineering technologist is explained in broad terms. Every engineering technologist is important in the role of improving our own, our companies and our communities education. Engineering technologists will be needed to work in teams to help solve societal problems (Lawlor, 2016). This societal need drives the need for an engineering technologist to understand the concepts within P-20.

P-20 education is an effort to bring leadership and collaboration between education, business and community organizations. Engineering Technology falls within the Engineering arena. Engineering Technologists are responsible for finding and implementing innovative solutions to aid institutions and society. Effective communication methods for engineering technologists are required to successfully improve learning. Barriers, walls, protection of turf and silos must be removed so that forward progress in the education process can be made (Council of Chief State School Officers, 2012).

P-20 encompasses a worldwide effort to address the issues within education. This paper discusses P-20 activities in the United States of America (USA). The P-20 effort is supported by various initiatives issued by the federal, state and local governments (Horn, Edwards, Greene, 2015). By 2020 the number of job openings that require postsecondary education and training, beyond high school, such as engineering technology, will reach 65 percent (Carnevale, Smith, & Strohl, 2013).

**Definition of P-20**

This paper addresses the question of “what is P-20?” The letter P and the number 20 have specific individual meanings. Discussions in various P-20 doctoral classrooms instruction in various courses indicated that the P in P-20 is characteristic of preschool, P representing preschool (R. Wilson, personal communication, April 27, 2017). The 20 is representative of lifelong learning (Northern Illinois University, 2017). The use or lack of use, of the hyphen is indicative there is not an accepted trademark for P-20 education. P-20 education is an effort to bring leadership and collaboration between education systems, businesses and community organizations.

In the last few years, there is a growing movement in the field of education that is referencing the term P-20. However, the term has not been formally defined. Individual organizations have worked to define the term by developing primer papers (Voices for Michigan’s Children, 2017; Aurora Public Schools, 2017). There are state leaders who are defining the term P-20. For example, in his 2015 state of the state speech to Michigan, Governor Snyder declared that he wanted education to focus on “pre-natal” [sic] through third grade which he termed as P-3. Governor Rick Snyder said that an important metric in an individual's life is to be able to read when in the third grade (Snyder, 2015). In Governor Snyder’s 2011 state of the
state address, he mentioned that now is the time to view the educational system as covering prenatal to lifelong learning for the individual. The focus should no longer be K-12 but P-20 (Snyder, 2011). Organizations, such as the Education Commission of the States (ECS) (2017), indicate that the 20 is indicative of higher education with the differentiation of the 16 being a bachelor degree. In other instances, the 20 indicates programs including a doctorate level degree (Aurora Public Schools, 2017; Davis & Hoffman, 2008; Dounay 2008). This extension of the meaning attached to the term 20 is often to accommodate professional programs such as law school, medical degrees, graduate and doctoral programs (Dounay, 2008). The term P-20 term seems to be accepted as lifelong learning inclusive of learning experiences after high school (Aurora Public Schools, 2017).

**P-20 Interactions with Government**

The impact of government on P-20 cannot be ignored. The government defines the methods to assess the effectiveness of teachers and recommends the use of testing and assessment to determine student success. The government also provides the funding that allows research and review of these educational activities (Education Research & Data Center, 2012).

Many government programs are helpful in implementing reform to education in the USA. The Race to the Top is an example of one of these programs. This program advances new ways to educate students through a personalized approach (U. S. Department of Education, March 25, 2016). Grants from these programs provide tools, information, and support to meet individual student needs in the classroom. The Northern Illinois University Outreach (2005) reveals that access to education helps to improve economic opportunities within the region of focus.

**P-20 Impact on Education**

In education, there is a struggle to identify whether education is an emerging industry, mature industry or even a declining industry (Barringer & Ireland, 2012). The difficulty is determining how to divide up the educational process and business expectations. Education is evolving as we pursue new P-20 initiatives which will help to ensure industry expectations are met. There are mature processes that are utilized in the teaching process on a daily basis, and there are methods of teaching that are being replaced as technology is introduced to the classroom. There is a need to develop new ways of instruction to reform the overall education methods currently in use. The result for these innovative methods would be to help to ensure a seamless transition from obtaining knowledge and skills to being career ready and enjoying lifelong learning (Patterson, 2011).

Education disruptors, a term used to describe those who promote the use of technology in education and want fast and agile change implemented in P-20 (Robinson, 2013). Being a disruptor in education is not considered a bad approach. However, some education leaders and technologists think that education disruptors are not effective leaders because they are not maintaining the expected cautious behaviors of the current educational leaders in making changes in the education process (Carmody, 2009). However, to ensure strong P-20 development of education methods, organizations are going to have to pursue innovation boldly and with speed.

Innovative methods need to be developed to address the emerging issues of sharing of student and institutional data in P-20. Will P-20 leaders implement open source solutions for education methods or will profit centers emerge generating income from the new education
methods developed in P-20? As innovative developments are made in the P-20 realm, individuals will be required to ethically decide the profit margins derived from emergent educational processes.

Innovative solutions are needed to address the rising cost of education. Engineering Technology programs were started as a cost effective and innovative method to fill needed technology positions within engineering technology job fields (Ford & Ball, 2011). P-20 leaders need to be aware of policies that affect the ability to pay for college. The availability of grants and federal loan programs help students to cover costs. However, there is data that suggests White and Asian students benefit from these programs at a higher rate than underrepresented minorities such as African American or Latino students (St. John, Daun-Barnett, Moronski-Chapman, 2013). P-20 solutions to help the student afford education solutions are important. Ron Paul (2013) suggests that with online courses, CLEP testing and the use of other online materials, a university degree can be obtained for less than a $15,000 investment. Online education curriculum solutions should be considered in order to lower the cost of high school by central development of curriculum and post-secondary education. Online and other methods of education are going to be important for the development of engineering technology programs and the improvement of education in general.

To ensure strong P-20 future development of education methods, organizations are going to have to pursue innovation boldly and with speed. An example of new innovation is co-design. Co-design is working collaboratively with others that involve leadership tasks where the unleashing and harnessing talent and great ideas are promulgated. To have innovation, there must be integrative problem-solving, creative abrasion and creative agility. All of these aspects are found in an engineering technology program. Creative abrasion is part of an institution’s culture where constructively challenging ideas are accepted. Leadership for innovation is often more of an effort in leading the individual from behind versus from a frontal form of leadership. The goal is to work on shaping the individual to have P-20 experiences that will foster innovation rather than about setting directions, methods and mobilizing people to follow a prescribed path (Hill, Travaglini, Brandeau & Stecker, 2010). Enabling these solutions will need increased computing power.

Hanover Research (2013) reports a rise of cloud computing within P-20 environments. Big data and more accurate learning analytics software will play a role in improving student outcomes in the future. To determine how to utilize cloud computing, big data or additional innovative ideas, we must understand how innovation leaders generate and implement new ideas. There is an increasing trend of nontraditional individuals putting pressure on established institutions to increase the pace and type of innovation. Change leaders continually get organizations, institutions, and companies to redefine the written and unwritten rules. These innovation leaders change the innovation environment. Moving from a few gifted individuals creating new concepts and ideas to an environment where innovative ideas are generated by widely distributed and talented people (Hill, Travaglini, Brandeau & Stecker, 2010). Enabling these solutions will need increased computing power (or at least more efficient use of existing computer power).

In P-20, innovation typically occurs at moments of peak interest. Ideas are often implemented immediately and culminate in about a year and a half. Dooley (1999) reports that enthusiasm for the benefit of action then declines, and the applied innovation dies in about four years. The cycle starts again with a different innovative idea gaining public support. This cycle
happens because the innovation (a) requires more effort than was initially expected, (b) the innovation supporters depart, (c) the personnel performing the ongoing maintenance of the innovative idea lack formal maintenance training, or (d) funds run out. In an effort to overcome this typical innovation lifecycle, P-20 leaders must carefully plan for the implementation of innovation. Especially if the innovation is a new concept and disruptive to the education process. When implementing changes to the P-20 education process, teachers must feel that some promising practices and procedures are being planned. The responsibility to reassure these teachers falls on the P-20 leader. Integrity and creditability are needed for a leader to effect change. (Dooley, 1999).

Diversity and the Impact on P-20 Education

P-20 includes principles of diversity and inclusiveness and will apply tools, techniques, and methods that reflect these convictions in their decision making as a P-20 leader. Within diversity, the goal is to include all individuals and groups wanting to participate in the P-20 education development and process. P-20 educators will strive to use creative methods to engage learners. These new education learning methods will lead to an eased understanding of new to the student ideas and concepts. To accomplish this easier learning, new methodologies for material presentation and development will need to be made. Leaders in P-20 will work to develop learning methods in sync with multicultural ethical understanding.

P-20 includes an understanding of applied ethics. Applied ethics are a rational moral review of single issues that occur in public and private life that requires moral judgment. Through this study, an attempt is made at identifying the morally correct action that should happen in everyday activities. An understanding of applied ethics and philosophical ethics must be known by the P-20 leader. In a pluralistic society, the directions of applied ethics must be understood. Applied ethics flow in the direction from meta-theory and methodology to theories and normative to major principles to institutional rules and finally comes to rest at actions and judgments. However, the path of philosophical justification flows in reverse and asks the question why at each step. Knowing why the applied ethics and philosophical justification works to help make decisions will empower the leader. The empowered P-20 leader will understand the meta-ethical aspects and the logical nature of the decisions that are made (Cooper, 2004).

P-20 collaboration is a strategy to address the challenges to college access for Latino and other underrepresented minorities (Núñez, & Oliva, 2009). Special education is another area that will bring new challenges for the P-20 education environment. Robertson, Sanchez-Lopez, Breiseth (2014) report that the need to address developmental learning issues, and those of students who speak a primary language other than English, will find that solutions for their educational difficulties will be combined with the requirements of special education. Special education methods will continue to develop a nondiscriminatory assessment and have a culture of humility. This approach will result in instructional programs which are culturally sensitive special education (Valdes, 1996). This combining of areas of special education will bring new challenges for the P-20 education environment (Villegas- Gutiérrez, 2015). The All Handicapped Children Act provides a requirement that children who have physical and developmental issues be able to receive equal education opportunities to their able-bodied counterparts. The disabled children and adult educational requirements will need to be addressed in a P-20 environment.
Areas of diversity beyond race are the (a) life situations of the student, (b) the teaching methods, (c) the learning methods, (d) the classroom techniques and (e) the use of music and art into the non-art classroom. The free lunch program is indicative of families that have low income and happen to also live in rural communities. In some communities, students do not have access to running water or bathroom facilities inside their home. Contrasting to these students are those who are considered academically gifted within the same community. There is a need for differentiated instruction in the classroom based on academic needs and remediation. This differentiation will help to equalize the education opportunities in the classroom (Brown, & Garland, 2015).

In discussion with Dr. Randal Wilson (R. Wilson, personal communication, October 10, 2016), his suggestion when considering the views expressed on diversity was the additional consideration of the diversity of thought. There are many perceptions of how thinking is performed. It is now possible to see the process through neuroimaging. Recently, the development of medical analysis tools to a point where monitoring of thought processes are performed using functional magnetic resonance imaging fMRI (Desrochers, Burk, Badre, & Sheinberg, 2016; Masson, Potvin, Riopel, Foisy and Lafortune, 2011). Neurological research is helping to identify the diversity of thought. This research will contribute to defining and directing the company tasks assigned to employees (Diaz-Uda, Medina, & Schill, 2013; Rose, 2011).

The P-20 higher education climate has changed to accept those who identify as Lesbian, Gay, Bisexual, Transgender, Questioning and Queer (LGBTQQ). This acceptance of LBGTQQ will expand to other schools, community, and organizations as acceptance and recognition continue to occur. Inclusive policies will allow students and workers not conceal how they identify. Allowing more focus can be on being productive. This will allow these individuals to be satisfied with school and work (Rankin, Weber, Blumenfeld, & Frazer, 2010).

International students travel to the USA to study within the education system. These international students often feel ignored and unimportant due to faculty and advisors lacking knowledge about international students, especially when the students attend a community college (Anayah & Kuk, 2015). There is a need for the P-20 community to develop individuals with an increased understanding of cultural diversity so that international students have a productive educational experience.

The needs of teaching and learning should be presented from the view and perspective of the prevailing culture of the society and then match the techniques to those used in the P-20 classroom. To attempt to use teaching techniques that are successful in another country such as Japan may not produce the same results in a class in the USA. Understanding the community is important when attempting to incorporate successful educational methods from other cultures or countries (Bransford, Brown, & Cocking, 2000; Oakes, Lipton, Anderson, & Stillman, 2012).

**P-20 Impact on Higher Education**

The community college system falls within both P-16 and P-20 education. There is a need to ensure that students are academically proficient so that there are seamless transitions from high school to higher education (Smith, 2008). P-20 must also include the degrees, certificates and badging that are earned at two-year institutions as these credentials are vital to industry and business employees.
P-20 students and engineering technology faculty will integrate innovative theories, practices, and concepts to explore solutions to complex issues in education. The ECS (2017) reports that the first P-16 council was established in Georgia in 1996. The P-20 program is innovative in not just the creation of the program, but the hybrid method of instruction which utilizes the most recent technologies in delivering education. Innovative teachers will contribute to the development of classrooms and schools that value diversity and civic mindedness.

P-20 institutions need to perform strategic planning. Setting a strategic plan is important for all the constituents of P-20 but is of particular importance to higher education. Special attention must be given to engineering technology programs to ensure that the programs are effective and meet the requirements of local and national industry. The community college and university accreditation programs are integral to the strategic planning process. A strategic plan is written to prioritize and define goals for the university. The oversight board for the institution will report on performance to the goals, often asking for help from the office of institutional research. Institutional researchers within these organizations contribute to the team by providing expertise in the strategic planning process and supply data as needed to the organization (Howard, McLaughlin, & Knight, 2012).

Institutional research and assessment are the systematic interpretation, gathering, and use of information concerning student learning. The assessment is then applied to determine methods of improvement. Assessment is done within departments to assure that learning outcomes are being met and that continuous improvement of teaching methods are taking place. The evaluation of student outcomes is done through analyzing, assembling and using quantitative and qualitative evidence of learning and teaching results. The results are then compared to the educational objectives feedback which is used for improvement (Volkwein, 2011).

P-20 higher education systems must be regionally accredited in order that credit will be accepted by other institutions. Six accreditation authorities exist and oversee compliance of the colleges and universities. The ten-year accreditation cycle is one that each institution prepares for by selecting a team of individuals to lead the effort. Future P-20 leaders need to provide innovative solutions automating the reporting of accreditation data. Universities and colleges understand that preparation for an accreditation review can no longer wait until two years before the end of the accreditation cycle. The leaders of the institutions are finding a need for ongoing monitoring to demonstrate that continuous improvement is occurring. P-20 leaders will need to be aware of quality assurance and control systems and procedures to assure that ongoing improvement are made (Howard, McLaughlin, & Knight, 2012).

P-20 Impact on Faculty

Students enrolling in and taking courses are part of the implementation of P-20. Course assessment needs to be determined before planning the layout of the material. Curriculum should be developed and integrated such that the courses buttress one another (Paul, 2013). The goals for course implementation is to have a good design to the execution of the material presented to ensure the student finishes a class understanding the material. The curriculum framework based on this course design will allow the student to acquire the facts, skills and be exposed to the big ideas of the course content (Wiggins & McTighe, 2005).The result of good curriculum design is a course sequence designed to interest students in the promotion of learning. Once the curriculum is in order course delivery can be considered. Course design must be considered before the creation of the course.
The exploration of human learning methods through neuroscience (such as grit, mindset, resilience, and motivation) will influence the learning and teaching methods to be changed. P-20 educators need to implement changes suggested based on knowledge gained from the neuroscience research into the formal instruction in preschools, kindergarten through high school, and also at the universities. All P-20 teaching centers, formal and informal, academic and institutional, will eventually use this new neuroscience research data to explore new methods of instruction allowing all students to have a chance to reach their fullest potential (Bransford, Brown, & Cocking, 2000).

Successful instructors will collaborate with others to ensure student success. Strong teachers will work together providing summative peer assessment of each other’s teaching effectiveness. These peer assessments will be used for merit, promotion, and tenure decisions. Formative peer observation assists in the improvement of teaching. Class auditing and continuous improvement training should be provided for reviewers to ensure that the results are consistent and beneficial to improving instructional delivery (Canale & Herdklotz, 2012).

**P-20 Impact on Researchers**

The P-20 researcher will work to research methods that address issues while addressing disparities in education. The role of research in P-20 is to identify the best practices in education with a focus on creativity and teaching (Aurora Public Schools, 2017). Since research is performed to disseminate information so that others can share in and study the results presented. The study will seek to identify solutions which will be durable and will provide long-term success. Within P-20 programs research is important to identify solutions in education. In community leadership research an emphasis on providing solutions to support non-profit and for-profit businesses. The P-20 researcher should also publish the results of their investigations. By implementing both qualitative and quantitative methods, P-20 researchers will advance educational research.

Regardless of the method used, the three primary goals for the P-20 researcher are practical goals, personal goals, and scholarly (or intellectual) goals. The goals can be motivated by a desire to improve or change an individual situation or practice. Or, there is a curiosity about a particular event or issue. These personal goals can often intersperse with the person’s research or practical goals. For the P-20 leader, there may be a sincere desire to resolve a problem that has a personal interest (Maxwell, 2013).

P-20 requires researchers who can synthesize and summarize the literature in regards to successful research to determine trends in behavior and opinion in teaching and learning methods. The use of statistically based quantitative goals will provide validation, focus, and accountability for P-20 transformation (Education Commission of the States, 2017). Innovative researchers will not be satisfied with reporting this information but will also want to act upon the data to develop new information and ideas. The role of research in education may have to be disrupted to allow the presentation of new ideas with only foundational research so that others may join in the exploration. P-20 researchers will need to become experts at choosing a method of the investigation and defining the purpose of the study. The P-20 researcher will then spend adequate time and thought (also incorporating feedback from others) developing clear research questions. Finally, a timeline will be created in which the study will be investigated, written and disseminated. The researcher should work to ensure that the study is completed in a timely fashion (Simone, Campbell, & Newhart, 2012).
Qualitative research is necessary to report on the status of the P-20 education system. This exploratory research can help predict future outcomes of educational learning processes based on interviews with subsets of the student populations. Qualitative research consists of approaches which include; (a) narrative research, (b) phenomenology, (c) grounded theory, ethnography and (d) case study. Each of these research methods has strengths, and there are many ways to conduct these studies (Creswell, 2013). These qualitative theories will work to capture the complex aspect makeup of the areas studied and will work to be successful in communicating the area studied (Maxwell, 2013).

The quantitative research method will be used in educational research reviewing data gathered into databases by researchers. For the institutional researcher, data mining and the ability to perform research within databases of information is going to be paramount. This type of the investigation will require not only statistical analysis but also data analysis techniques involving supervised and unsupervised approaches. The unsupervised technique is highly exploratory on subsets of data and involves the researcher using charts and tables to look for trends. The unsupervised methodology, the researcher looks for connections in the data. In the supervised technique, the researcher approaches the data with prior knowledge of the patterns in the database and looks for predictive outcomes. The researcher then develops the best predictive model based on the dataset. The predictor model most common in the statistical package for social sciences (SPSS) is the linear regression technique. Other techniques now include artificial neural nets used to show visual representations of the dataset. Displaying data graphically to show relationships in a dataset is helpful to communicate results to users of the data mining activity (Luan, Kumar, Sujitparapitaya, & Bohannon, 2012).

**P-20 Impact on Students**

Students will demonstrate exceptional understanding and knowledge of the unified P-20 approach to education through the implementation of these initiatives. Engineering technologists must remain knowledgeable of the systems that they support and how to support these systems. Engineering technologists must be leaders in attending and providing lifelong learning opportunities. Leaders within the P-20 continuum must work to ensure that lifelong learning is an opportunity for all individuals to pursue. To successfully implement strategies and implement change, the P-20 leader must be grounded in a strong understanding of human behavior in the P-20 environment (Burke, 2007). These teachers will implement teaching methods that contribute to positive academic, attitudinal and social outcomes for students. P-20 teachers will use several resources to implement the planning and to structure engaging learning opportunities for their students. P-20 teachers are also those who homeschool their children.

Some areas that fall within P-20 that also need to be addressed are extensions of the education system including homeschooling. More data is being gathered to address the methods and quality of homeschooling (Norton, 2012). An often neglected area of P-20 education is craft or trade education. Edward Aczon, Executive Director of the Hawai’i Carpenters Apprenticeship and Training Fund, states that the P-20 effort in Hawai’i wants students to be introduced to the skilled trades. The students will learn trade skills and options for careers (Hawai’i DOE, 2017). The community must not be ignored when defining P-20. The town village must be considered as the comment that a village is needed to educate a child (Clinton, 2006). P-20 embraces the village concept as the community is an active part of the education of the children (Holly, 2017; Ho'okāko'o, 2017).
P-20 Impact on Business

The Center for Educational Leadership and Technology (2014) relates that business training, learning, and education are part of the P-20 current and future development. Onsite training within organizations can build talent and offer a second chance training and education allowing employees to learn new skills and improve existing skills to provide necessary development which enhances corporate organizational growth (Aurora Public Schools, 2017; Horn, Edwards, Greene, 2015). Businesses and other profit centers can benefit from an organizational learning audit. This review would identify training and education opportunities which individuals could gain from. These training events would increase the productivity of the individual; thereby generating revenue for the company.

P-20 Impact on Leaders

Implementation of P-20 initiatives requires not only leaders but team players. The key to being able to lead is to be surrounded by those who can function on a team. Lencioni (2002) notes that team dysfunctions can be identified as a pyramid at the top labeled with the inattention to results and descending due to lack of commitment, avoidance of accountability, the avoidance of conflict and lack of trust as the makeup of the dysfunctional pyramid. The ideal team player should be humble, hungry and smart (Lencioni, 2016). A P-20 leader must be able to identify these traits in others and cultivate these individuals so that improvements to P-20 can be implemented. P-20 educators need to instill leadership capacity in P-20 students through practice, research and significant professional growth. Engineering technologists will pursue engineering technology leadership positions.

P-20 students will build capacity for leadership through practice, research and significant professional growth. P-20 leaders must believe in themselves, and engineering technologists can pursue engineering technology leadership positions. Future education leaders must have a good understanding of ethics as identified by Kouzes and Posner (2011) to be respected leaders of the company. Students through practice, research and significant professional growth. Engineering technologists will pursue engineering technology leadership positions.

Bolman and Deal (2014) outline the four frames of leadership: The four frames consist of structural, symbolic, political and human resources. P-20 leaders must understand the four frames and evaluate problems from the perspective of each frame. However, innovative leaders in P-20 will reach out beyond this framework and assimilate the leadership styles that exist beyond these boxes formed within the frames.

Former USA presidential candidate Ron Paul (2013) states that all education should be the focus on education for leadership. Leonard Read (Read & Galles, 2013) emphasized that the foundation of leadership be the continual focus on self-improvement. Self-improvement can only be developed through studies of leadership coupled with the individual’s desire to grow and participate in self-transformation. P-20 leaders must work to provide leadership not only by direction but through individual action. The leader must have strong ethics and integrity.

P-20 will require global minders leaders readily able to navigate the culturally supported leadership theories. This understanding and cultural awareness will allow the leader to influence those who are of different thought and action. Their global mindset will be made up three major elements: social capital, psychological capital and intellectual capital. P-20 education for leaders
will help global leaders understand and assess their individual potential in dealing with culturally diverse groups and organizations (Javidan, Dörflman, Howell, & Hanges, 2010). The engineering technologist not only needs to understand culture but needs to be familiar with ethical theories and actions.

David Cooper (2004) expressed the need to practice ethics theory when leading in a cultural setting consisting of a diversity of thought, culture, and individuals. Leaders need to ensure that ethics and implementation methods are used correctly and equitably. Cooper's five steps provide guidance through institutional rules, theories, and principles. The combination of integrity, ethics, and guidance will be needed to determine the future changes needed to the P-20 environment.

Brown & Treviño (2006), suggest that ethical leaders must (a) be empathetic and honest, (b) have defined principles and (c) have the integrity to make fair and balanced decisions. The leaders will discuss ethics and have the ability to set clear ethical standards. The P-20 leader will provide praise when earned and discipline when needed. P-20 leaders will need to break down institutional barriers, remove silos and help to develop communication and collaboration (Sart, 2014).

In addition to the skills listed above, the P-20 leader must have three critical skills which are understanding the leadership paradox, diagnostic capabilities and understanding their own behavioral makeup (Chatman & Kennedy, 2010). These three skills will help a leader to assess what is a unique and maximum value that leader brings to the situation.

To accurately evaluate situations, Cherniss (2000) relates that a leader needs to call upon their emotional intelligence. Emotionally intelligent individuals are often more capable of controlling their emotions. This ability allows an enhanced state of cognitive processes and improved decision making. The leader also needs a flexible and broad behavioral range to respond judiciously or diplomatically across a multitude of complicated problems. Most people react to situations using a set behavior pattern; a P-20 leader must have the ability to act appropriately with the correct action from many different behavior patterns. Finally, a leader must realize that the leader’s success is obtained through the actions of others. The leader cannot attempt to be a hero and perform every task themselves.

Authentic leadership, a positive leadership style occurring more frequently, is important for P-20 growth. This leadership style allows for simpler, but profound, methods for the leader to self-actualize and work at optimal influence levels with their teams and peers. With the development of authentic leaders, the P-20 environment is poised to evolve in leadership training and education.

Current leadership training takes the form of two or three-day exercise in leadership development. Leaders are then left to execute the new strategies they have developed. The freshly trained leader has no understanding of how well they are, or are not, implementing their new skills. With the advent of such technology as the Apple wristwatch, two-way communication makes immediate feedback available to the P-20 leaders (Avolio, 2010).

Marturano (2014) summarizes that mindful practices enhance mental health and improve leadership performance. Leaders also need to find time and space to recharge. Leaders must have focus, clarity, compassion, and creativity. Leaders should practice mindful leadership techniques. Using a transformative experience to separate oneself from the anxiety of work for
even one minute can help to improve self-awareness, listening skills, improve the ability to innovate and allow considered decision making (Marturano).

**P-20 Impact on the Individual**

A final P-20 area to explore is the individual’s pursuit of education through reading or online education solely for personal satisfaction at high schools, community colleges, and universities. La Belle (1982) outlined lifelong learning that are informal and formal education methods that an individual could pursue. In the community college programs, the non-traditional student will pursue hobbies such as writing, personal reading, woodworking, gardening or other activities of particular interest. The individual’s goal is to add their personal education requirements into their daily activities and address these needs through informal and formal education. Informal methods would be self-directed activities based on reading, internet searches and a visit to the library.

**P-20 and Future Research**

There are many areas that require further research. Student access to P-20 education is an area of research that must be continued to be explored. Schools are affected by extreme political, social, economic and technological changes; but most education institutions have not changed their organizational structure. The P-20 researcher must realize that methodology and curriculum must change and adapt. A restructuring of education must occur (Dooley, 1999; Paul, 2013).

Student access to education is an area that of research that must continue to be explored. Accessibility to those who are low, middle and high-income need to continue to be researched and explored. The effects of tuition rising while grant availability declines will make attaining an education difficult for underrepresented students. The distribution of merit-based aid needs regular review as an understanding is developed that some underrepresented students can only perform as well as their high school programs can afford to prepare them. Research is needed to determine how increased percentages of the underrepresented population would be able to perform well in a college or university. Policy initiation and methods of public funding distribution continue to need to be explored (St. John, Daun-Barnett, Moronski-Chapman, 2013).

**Summary**

The P-20 education effort will foster an individual's desire to share, know and learn information that is known and have a desire to investigate new ideas. Engineering Technologists work to bridge the requirements of engineering and often pursue leadership positions which allow the technologist to investigate and implement ideas and solutions. The P-20 education process will be communicated cross-culturally resulting in an effort to learn from others throughout one’s life. There is a significant challenge for a P-20 leader to knock down silos and build bridges between the educational institutions, government, and community (The Council of Governments, 2009). For P-20 to be successful, there needs to be clear communication between high schools and universities so that there is an understanding of the skills students must have to succeed in college. Professional development and improved teacher preparation need to be addressed throughout the educational system. For P-20 to achieve program goals and objectives, the number of diverse students needs to be increased. This diversity can be accomplished by an
emphasis on programs that work with students and parents discussing a plan for higher education with their children.

Conclusion

P-20 will continue to morph in meaning. This change is unavoidable as evolution occurs within the education, business and local, state and federal communities and governments. The term P-20 is going to have sticking power as long as there is not a paradigm shift in education which removes or invokes currently unknown education processes or institutions. The P-20 education industry will need to embrace Bolman and Deal’s (2008) concepts allowing the employees and contributors to not only express their skills and ideas but participate in the new idea development and implementation.

There is agreement that collaboration between education, industry, and government is needed to meet student, parent, local, state and federal goals. Performance feedback needs to be established so that receiving institutions can provide information to the suppliers of how the students and learners are performing in the next level of education. However, the P-20 community is continuously realigning the P-20 educational goals and objectives within short time periods of one to three years. P-20 leaders and programs will continue to flounder and progress will be sporadic, until P-20 leaders and community members join together in setting and publishing overarching goals for the five to ten year periods. The goals must be defined, measurable outcomes which empower leaders and hold these leaders to be accountable for improved educational results.
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