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An Investigation of Utah Technology Education Teachers' Acceptance of an Emphasis on Engineering Education Content

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AN INVESTIGATION OF UTAH TECHNOLOGY EDUCATION TEACHERS' ACCEPTANCE OF AN EMPHASIS ON ENGINEERING EDUCATION CONTENT

by

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ABSTRACT

AN INVESTIGATION OF UTAH TECHNOLOGY EDUCATION TEACHERS' ACCEPTANCE OF AN EMPHASIS ON ENGINEERING EDUCATION CONTENT

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Master of Science

The purpose of this study is to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in technology education. The Stages of Concern Questionnaire (SoCQ) was used to determine the level of acceptance of this change. It was found that a majority of technology and education teachers are more concerned about other unidentified tasks, activities or initiatives than they are about the addition of engineering content to their classes. They were also shown to be concerned with being able to organize, manage, and schedule the change effectively and were found to be least concerned about evaluating student outcomes including performance and competencies. Utah teachers were polarized with respect to collaborating and coordinating with others with regards to engineering.

ACKNOWLEDGMENTS

At the completion of an effort that can at times seem so self-absorbing, it is appropriate to pause and in a spirit of gratitude offer thanks to the many who have made it possible. This study and the education that led up to it would never have been completed without the unfailing and loving support of my extraordinary wife Melanie, along with the patience and understanding of my children. All that I do or have ever done stems from this.

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I offer my appreciation to Dr. Hawks and Dr. Terry, each doing so much to sharpen my focus and to refine the substance of this research. Through each of them my life has been enriched and I wish to acknowledge their fine contribution.

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1 Introduction

Throughout its history, technology education has struggled to establish a unified philosophy and approach to instruction. Some feel it should be used to develop marketable skills for the students headed for the workforce. Others feel efforts are best expended creating a greater degree of technological literacy within all students as part of their general education. Recent discussion within the profession has centered on the degree to which engineering should be used as a means to achieve either objective.

1.1 The Historical Roots of Technology Education

1.1.1 Apprenticeships to Formal Instruction

Bennett (1926; 1937) and Barlow (1967) traced the roots of technology education back to cultures that existed well before the Renaissance. Bennett described how apprenticeships and the guild system that emerged in Europe began to more formally address the need for both skills training and a more liberal education, stating that "…apprenticeship was the chief educational institution for middle-class youth of the Middle Ages." He quoted Scott (1914) indicating that during this age the youth received non-technical as well as technical training through an apprenticeship. "A general preparation for life—moral, religious, and civic instruction—was offered as the apprentice learned the practice and mysteries of his craft."

Iconic figures such as Luther, Rabelais, Comenius, Locke, and Rousseau influenced the development of educational philosophy strengthening the importance of manual training as part of a liberal education. Bennett (1926) demonstrates how innovators such as Pestalozzi, von Fellenberg, Wehrli, and Froebel experimented with these ideas, reducing theory to practice, and in the process paved the way for the Manual Labor Movement in America.

1.1.2 Manual Labor Schools, Mechanics Institutes, and Lyceums

Bennett (1926) recounts how a division in educational philosophy developed within the profession as the Manual Labor Movement became recognizable. Some Manual Labor Schools were formed as a means of providing orphans and other less fortunate children with some form of an education. In order to be self-sustaining, the proceeds from the sale of items made by the students were applied to their tuition. Other manual labor schools were formed with the idea of presenting a superior approach to teaching; uniting heart, hand, and mind. Whatever the social agenda, the students developed marketable skills in a trade that would serve them as an adult.

Along with the industrial age came the emergence of mechanics institutes and lyceums. Bennett (1926) indicates that they were developed in an effort to provide a satisfactory substitute for (1) the apprenticeship method, (2) the master's method of imparting the technical knowledge connected with a trade, and (3) the general schooling and moral discipline that formerly was a part of the apprenticeship training.

1.1.3 Russian System and Sloyd Influences

Bennett (1937) documented the influence that Della Vos's Russian system and Cygneaus's and Salomon's Sloyd system had on mechanical arts. The Russian system broke the mechanic arts down into methods that were "… true whether one thinks of manual arts as being taught for vocational purposes or as part of a general education". Cygneaus, on the other hand, intended Sloyd for "… the development of the eye, of the sense of form, and the provision of a general manual dexterity, and not some particularized and insisted skill".

Bennett later highlights the key distinction between the two emerging educational philosophies.

> "In no respect was there a greater contrast between the Russian system and the Swedish system as developed by Salomon than in the aim of the work. The Russian system was definitely devised to train skillful, intelligent mechanics. In modern terms, its purpose was strictly vocational. The Swedish, on the contrary, was for purposes of general education; it was considered valuable for every child. Moreover, the Russian system, devised by a government engineer, was put into operation like other engineering enterprises, with speed in learning and the engineering result constantly in view, and with little regard for individual learning capacities; it was a mass-production system of special education. The Swedish system, on the other hand, was worked out by

an educator whose primary interest was the enrichment of the education of all children during the elementary school period, recognizing individual capacities and individual speeds in learning; it was an individual-production system, not a mass-production system of general education."

The two seemingly competitive philosophies had each taken form, just as the movement towards a public school system in the United States was gaining momentum. The failure to effectively marry the philosophies that shaped the Russian and Swedish systems is an impediment to teaching technological literacy that survives to this day.

1.1.4 Merging with Public Education

Barlow (1967) stated, "The awakening of educational consciousness in the United States occurred about 1820. General enthusiasm for public schools was slow to develop, but over the next fifty years the idea of the common school, public and free, became woven unmistakably into the fabric of American culture." He went on to assert, "Education needed by all men became the goal, and slowly but steadily more and more children were brought under the influence of the common school. A large percentage of the children were the sons and daughters of workingmen and laborers, and the common school would largely represent all their formal education experience. If the studies and methods of the common school were to be adapted to the needs of any class of people, then it ought to be the working class."

The prevailing educational current of the time is illustrated by Thompson (1877) writing, "Culture and discipline are not so much dependent on *what* is taught as upon *how* it is taught." and "Education should be a preparation for life and should be like the life to which it prepares."

Barlow (1967) characterized the struggle to balance the emergence of a consideration for practical education with manual and trade education as the "educational battle of the century". Before the first decade of the 20th Century came to a close, the promotion of Vocational Education was fully engaged, and efforts to develop "educated laborers" were solidifying as industrial education. Professional organizations soon followed. The American Vocational Association (AVA) was formed in the 1920's and the American Industrial Arts Association (AIAA) was founded in 1939.

1.1.5 Technology Education in the Modern Era

The launch of the Russian Sputnik satellite resulted in a profound shift towards an essentialist education within the United States. Vocational education and industrial arts programs were both weakened in the process.

In response, the West Virginia Department of Education invited a number of noted experts in the field to a conference held at Jackson's Mill in the effort of developing a plan for improving their vocational education and industrial arts programs. That conference led to the development of a new ideal, "Technology for All Americans". In the following years, the AIAA was renamed the International Technology Education Association (ITEA) and in 2000 it published the Standards for Technological Literacy (STLs).

The STLs establish standards and benchmarks for developing technological literacy. They draw heavily on design, but also support an increased awareness of the impacts of technology on society and the environment. They also include standards that promote familiarity with technologies used in a number of different basic industries.

1.1.6 Technology and Engineering Education

Spencer and Rogers (2006) found that "… recent technology education graduates find themselves entering an ever-changing technological field which is suffering from an identity crisis." They went on to say "For many years, technology educators have been searching for a universal identity, something that is easily recognizable and effectively represents the fullness and diversity of their field." Wicklein (2006) suggested five reasons for the field of technology education to strongly consider engineering design as a primary focus. In an earlier study, Lewis (2004) found "Three states (Massachusetts, Utah and Wisconsin) now include engineering in the official name of the subject." Spencer and Rogers (2006) observed that "... in Utah, according to the Career and Technical Education Association, technology education has changed its name to technology and engineering education. Despite the name change, the mission statement for the program, as stated by the Utah Technology and Engineering Department, is similar to previously stated goals for technology education."

Berrett (2005), in conversation with the state office of education specialist for technology and engineering education, noted "… it was clear that the name change brought clout to his endeavors. Especially, he claims it brought a 'solution' to the high school technology education problem of 'legitimate' technological literacy curriculum."

1.2 Problem Statement

The educational philosophy that underpins manual and technical training varies and has evolved over the years. Two trains of thought dominate the discussion: (1) education for a vocation, and (2) technical and industrial training as part of general education. Technology education evolved from industrial education, which in turn developed from manual training. With each change came revision to the content of what was being taught (from manual training to a study of industry to the pursuit of technological literacy).

The wisdom of promoting engineering as the proper focus for technology education has been debated nationally for many years. The State of Utah has changed the name of its technology education department to technology and engineering education, however, it is undetermined to what extent Utah teachers within the field are aware of or have accepted these changes.

The problem is that as the names of the profession were changed and content (manual, industrial, technology, engineering) of the courses were redesigned, it is not known if the teachers' perceptions and acceptance of the change also evolved. It is important to understand this before we can know if the change is anything other than merely theoretical. In order to do so, we need to know to what degree technology and engineering education teachers in Utah are concerned about:

- the addition of engineering to their course content
- a need for them to learn more about engineering
- their ability to learn more about engineering in order to better teach it

- developing strategies for implementing the change
- how the addition of engineering content will affect their students
- collaborating with their peers to develop engineering content
- alternative ideas to an emphasis on engineering content

1.3 Significance

The purpose of this study is to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in technology and engineering education. Education leaders can then better determine the pulse of the general populace of technology education teachers. It is not fully understood if the content being taught is reflective of the new philosophy.

In the past, especially when industrial arts changed to technology education, perception studies such as this were conducted. With the addition of engineering content to the current philosophy, it is imperative for education leaders to again investigate if this philosophical change is being accepted by the technology education community.

It is entirely possible that those in leadership have decided a change should take place without the change being ratified by their constituents. If the general populace of technology education teachers does not accept the change then the leaders must either rethink the change or place effort into educating and convincing the general populace of the need.

This information is needed to better understand to what degree technology and engineering teachers in the State of Utah are concerned about:

- the addition of engineering to their course content
- a need for them to learn more about engineering
- their ability to learn more about engineering in order to better teach it
- developing strategies for implementing the change
- how the addition of engineering content will affect their students
- collaborating with their peers to develop engineering content
- alternative ideas to an emphasis on engineering content

Educators and administrators would then better know if dissent exists. If so, they might also better know how to address it. Furthermore, they may also be better informed as to whether or not any additional changes are justified. Finally, technology and engineering teacher educators would also know if adjustments to the courses offered to technology and engineering education teachers need to be made.

1.4 Research Question

The research question is: What is the level of acceptance among secondary education teachers in the State of Utah teaching technology education courses to an emphasis on engineering content in their discipline?

In order to answer that question, a survey will be conducted asking technology and engineering teachers in the State of Utah to what degree they are concerned about the following research points:

1. the priority on engineering in their course content
2. learning more about engineering
3. the process of learning more about engineering
4. developing strategies for implementing engineering content
5. how the addition of engineering content will affect their students
6. collaborating with their peers to develop engineering content
7. exploring alternative ideas to an emphasis on engineering

1.5 Delimitations

This study will not include information pertaining to the following issues:

- The perception of change in technology and engineering education by students, parents, counselors, administrators, state supervisors, technology education teacher education professionals, or trade and industry educators.
- The level of acceptance of engineering content among technology and engineering teachers in private or charter schools.
- Impact on trade and industry programs in the State of Utah.
- The level of use or application of technology and engineering in the State of Utah.
- The relative definition, ideology, and philosophy of technology and engineering education.

1.6 Definitions of Terminology

For the purposes of this study, the terminology employed in this thesis regarding various educational philosophies shall be understood as defined below.

Manual Arts: The term manual arts began about 1893 and grew out of the manual training movement. Because of its place in the general education curriculum and its focus on practical projects, this trend found its influence primarily in the Swedish Sloyd system rather than the Russian system of manual training. Courses generally included mechanical drawing, woodworking, and metalworking. This training did not, however, include design training. In the manual arts movement students were involved in the manufacture of craft oriented projects. These projects were used to teach tool skills and knowledge.

Mechanic Arts: The most famous usage of the term mechanic arts (and the one in which it is most commonly encountered today) is in the Morrill Land-Grant Colleges Act. In the 19th century, it referred to fields, some of which are now known as engineering. It was apparently an attempt to distinguish these fields from creative and artistic endeavors like the performing arts and the fine arts which were for the upper class of the time and the intelligentsia. It was also considered a practical field for those that did not come from good families.

Industrial Arts: Charles R. Richards, director of the Manual Training Department at the University of Missouri, first used the term industrial arts in 1904. This term was used to describe education that was part of the general education program. Also known as "shop class", these programs exposed children to the basics of home repair, manual craftsmanship, and machine safety. Most industrial arts programs were established in comprehensive rather than dedicated vocational schools and focused on a broad range of skills rather than on a specific vocational activity.

Industrial Education: An approach to learning from an industry perspective. With traditional technical teaching methodologies in educational environments, the conventional pathway is to build the foundation learning through subject based teaching of mathematics, physics and science independently. Subjects based on the relative topics required for the discipline usually follow on from this. With traditional methodologies of learning there is no close relationship with industry requirements.

Vocational Education: This term arose as a result of the Douglas Commission in 1905. This term is used to designate trade education that is separate from the general education curriculum. Vocational education prepares learners for careers that are based in manual or practical activities, traditionally non-academic and totally related to a specific trade, occupation or vocation, hence the term, in which the learner participates.

Up until the end of the twentieth century, vocational education focused on specific trades such as for example, an automobile mechanic or welder, and was therefore associated with the activities of lower social classes. As a consequence, it attracted a level of stigma. Vocational education is related to the age-old apprenticeship system of learning.

Technology Education: The technology education movement of today arose from the industrial arts movement. Like industrial arts, it is generally part of the general education curriculum.

Technology education programs are available at the elementary, middle/junior high school, and secondary levels. At the elementary school level, the focus is on technological awareness with classroom activities oriented around the development of motor skills and informed attitudes about technology's influence on society. At the middle school level, the focus of technology education programs is on exploring the applications of technology to solve problems and exploring the various technological careers. A wide variety of problem-solving situations are used, giving students opportunities to create and design. Activities are designed to further promote technological awareness and to promote psychomotor development through processes associated with technology. Secondary technology education programs are designed to give students experience related to scientific principles, engineering concepts, and technological systems.

2 Review of Literature

2.1 Introduction

In order to gain an understanding of the available literature pertaining to the acceptance of change among technology education teachers in the State of Utah towards a stronger emphasis on engineering and design in their curriculum, the following literature review was conducted. First, a review of papers concerning research in technology education was completed to confirm the validity of this research. Then, a review of studies on the subject of teachers' perceptions of change was completed. Those investigations provided a significant foundation for this study and did much to help shape the research questions of this research.

This chapter is divided into four sections. Section one is a synopsis of the review of literature procedures followed in this study. Section two offers a brief summary of previous reviews of literature pertaining to the research needs of technology and engineering education. Section three contains reviews of related articles, papers, and studies specific to the acceptance and perceptions of change in technology and engineering education. Section four concludes the literature review, establishing a justification for the need of the research to be conducted in this study.

2.2 Review Procedures

Selecting studies for review was accomplished through various research tools. The majority of the review was conducted using online search tools available through Brigham Young University's (BYU) Harold B. Lee Library to review the ERIC, Compendex, and Web of Science (ISI) databases. The advanced search option was selected using descriptors such as "technology education" along with other key words such as "aims", "acceptance", "attitudes", "change", "history", "objectives", "philosophy", "research", and "teachers". Because the discussion of technological literacy within the field did not emerge until Jackson's Mill, the search was restricted to literature published since 1990. A similar search was conducted using Google Scholar beta produced little. A search of the electronic Masters Theses Directory established one unpublished thesis having to do with technology education. Two other unpublished theses were obtained through the BYU College of Engineering's School of Technology and Engineering Library.

The reference sections of all studies located through this search were then combed for additional articles, papers, and studies that appeared relevant. Further, a search was then conducted of selected authors' names in an effort to discover additional, if only similar, material on the subject. This technique proved to be particularly fruitful. Finally, the contents of several prominent technology education journals published during the 2000-2008 timeframe were searched volume by volume via the internet.

2.3 Review of Previous Reviews

This study builds directly on the Master's thesis developed by Dr. Jared Berrett (1999) while a graduate student at Brigham Young University. Ten years after the shift from industrial arts towards technology education began at Jackson's Mill, Berrett conducted a study to "establish a body of knowledge documenting technology education/industrial education teachers' perceptions and acceptance of change in technology education as the field's most recent innovation in the state of Utah" (Berrett, 1999, 6). Research for this study focuses mainly on the literature released after Berrett, while at the same time taking benefit from the efforts of his research.

Berrett located several integrated reviews of the literature. Chief among them was a comprehensive review of technology education research conducted by Dr. Karen Zuga (1996). She listed a total of 271 published reports, presenting her findings, "Review of Technology Education Research", at the Technology Issues Symposium in 1996. Zuga reported a "gap" existed between the ideologies professed by the teacher educators and what they were practicing. As a result, the teachers remained inclined towards vocationalism and skill development, significantly inhibiting their ability to transform skill-based industrial arts practice to technology education for general education. Zuga did not include any Master's theses in her review. While a large body of such research exists, they are often unpublished and can prove difficult to fully catalog.

Foster (1992) wrote a paper called “Topics and Methods of Recent Graduate Student Research in Industrial Education and Related Fields.” He reviewed 508 dissertations and theses completed by graduate students in the field. Foster’s study was limited by the response rate of the degree granting institutions, the classification categorizations chosen, and the use of abstracts rather than a review of the full texts. He found the most common topic researched was “program/project evaluation”, accounting for 20% of the studies. Foster (1992, 1) used DeVore’s words, criticizing the field saying “that the majority of studies are stand-alone studies that do not build upon previous research”. In a later study, Foster (1996, 6) looked at the critical issues facing the field. Out of a total 21 Major Topics, he found the top three issues to be (1) Integration of education disciplines Math, Science, and Technology; (2) The role of technology in general education; and (3) Rationale for technology education. Foster recommended we “develop a comprehensive research agenda that employed more powerful research methods” (Foster, 1996, 2). Foster’s study was limited by the organizers he used, his methods of categorization, and the sample size.

Liedtke (1995) reviewed the contents of several leading journals in technology education published between 1988 and 1996. Her review of 332 articles identified a deficiency of articles on important issues such as “technology as a discipline, technological literacy, and the pedagogy for learning technology.” She recommended that “technology education as a discipline must be clearly defined, disseminated, and operationalized." Like Foster, she saw a need to develop a research base that would create a uniform body of knowledge.

Pucel (1994) wrote a document entitled "The Trade and Industrial Education Research Agenda: Implications for the Field." It was a review of two separate studies: the first an examination of articles published in leading technology education journals, the second a survey of Mississippi Valley Conference members. In the first, he found "that technology education has substantial validity and recognizes the need for substantial change". In the second, he found that technology education research has focused on the changing requirements of society and the implications for the future (Pucel, 1994, 2)

Lewis (1999) attempted to identify needed areas of research. He outlined eight areas of potential investigation: (a) technological literacy, (b) conceptions and misconceptions of technological literacy, (c) perceptions of technology, (d) technology and creativity, (e) gender in technology classrooms, (f) curriculum change, (g) integration of technology and other school subjects, and (h) the work of technology teachers. Of those eight topics, the last is perhaps the most relevant to this study. Lewis suggested further inquiry relating to (a) the work of professional lives of teachers, (b) the experience of beginning teachers, and (c) exemplary teachers.

Cajas (2000a, 67) responded directly to Lewis' suggestions, proposing "that the discussion on research in technology education also needs to consider what students should actually learn after they complete their technology education programs." Promoting the notion of technological literacy for all, he asked, "What knowledge and skills should everybody know?"

A few months later, in the same journal Cajas (2000b, 78) conveyed some research suggestions resulting from discussions among participants in the American Association for the Advancement of Science/Project 2061. This second editorial also focused strongly on research centered on students and what they learn. However, some attention was given to studying "how teachers themselves understand – and come to understand – technology."

2.4 Primary Research Studies

At least four studies on the acceptance of technology education have been conducted since Berrett (1999), each evaluating an aspect of change within a state. The earliest of these, Bussey, et al. (2000), explored the factors that lead to adoption of technology education in New Mexico. While delegates for the American Industrial Arts Association (AAIA) had voted to change the name of the organization in 1984 (Godla, 1988) to the International Technology Education Association (ITEA), at the time of Bussey conducted her study, the technology education teachers surveyed in New Mexico would not yet have the Standards for Technological Literacy released in 2000. The results of her study and the STLs were published almost simultaneously.

As a part of their literature review, Bussey, et al. identified a study conducted by Rogers and Mahler (1994), showing that the majority (775) of industrial education teachers in Nebraska did not accept the shift towards technology education. They also cited a study by Swanson (1981) that found a majority (68.8%) did not adopt the notion of technology education. Both of these studies stood in stark contrast to the position of most leaders in the field who held that technology education must be “diffused into the current educational setting.”

Relying on the methods of E. M. Rogers (1995) to identify the factors that influence the adoption process, Bussey, et al. developed a theoretical framework for their survey instrument. Rogers proposed that innovations possessing certain attributes are more likely to be adopted; namely, “relative advantage, compatibility, complexity, trialability, and observability.” Further, Rogers proposed that adoption of an innovation is related to a process wherein an individual first passes from knowledge of an innovation to forming an attitude towards the innovation, deciding to adopt or reject the innovation, implementing the idea, and confirming the innovation idea. Finally, Rogers proposed that the channels used to communicate the innovation and the social system in which diffusion takes place are factors that determine the rate of adoption of an innovation.

Rogers makes the claim that there are essentially three possible types of decisions that can be made regarding the innovation. The adopting individual can be almost completely responsible for the decision, an individual can be influential to a group decision, or the decision can be made by an authority leaving the individual without influence in the matter. Decisions made by an authority are acknowledged to be the fastest, but generally create animosity among those who will implement the change.

Bussey, et al. suggested that the AAIA's decision to change to the ITEA was such a change, one decided by authorities, allowing little input from the membership. G. E. Rogers (1989) provided an outline of this problem in his study, pointing out that only a small percentage of the teachers affected by the 1984 name change were AIAA members. Subsequently, there was some resistance to a change from industrial arts to technology education.

Bussey, et al. identified several other factors creating a poor climate for change. They suggested technology education is more complex than industrial arts, and that industrial arts teachers are not inherently compatible with the new curriculum. In addition, evidence was presented to suggest that industrial arts teachers were unwilling to try the new program due to a lack of stable support offered from their administration.

Based on E. M. Rogers' work, Bussey developed a survey instrument to determine the key factors inhibiting or promoting adoption of technology education. An inadequate budget, inadequate facilities, and inadequate resources led the list. The leading factor promoting adoption of technology education was shown to be a personal interest on the part of the teacher. The teachers' leading suggestion for strengthening technology education was to increase the funding.

Two years after the release of the STLs, an article appeared in *The Technology Teacher* summarizing a study conducted by Reeve, et al. (2002).

The stated intention was to evaluate the knowledge and use of the technological literacy standards among technology education teachers in the junior high schools of Utah. Administering a survey instrument of their own design, Reeve, et al developed a series of 14 questions with responses consisting on simply “yes”, “no” or “other”. They found that almost all junior high school teachers (93%) felt that there was a need for standards for technology education. Most teachers (76%) felt that the standards will help strengthen the image of technology education. Most (76%) would implement standards-based curriculum if available. Most (approximately 81%) felt that their own background and training had adequately prepared them to teach any of the five major categories; namely, Nature of Technology, Technology and Society, Design, Abilities for a Technological World, A Designed World.

Reeve distributed 107 surveys forms and 51 participants responded. The majority (75%) of respondents indicated that they had a copy of the STLs, and 70% had read them. A number of the open-ended responses referred to a need for more in-service professional development. While the Utah teachers surveyed felt qualified to teach the categories of content, only 19% of the teachers had been in-serviced. Almost all teachers (85%) would attend training if offered.

Seventy-eight percent of the respondents asserted that they were modifying their curriculum to “reflect” the standards. The study frankly acknowledges an inherent flaw in the survey. Rather than asking “Have you started modifying your curriculum to reflect the standards?”, they should have asked, “Is the curriculum becoming standards-based?” The importance of beginning with the standards as opposed to modifying existing curricula and activities was noted. Confusion is admitted to exist over what constitutes standards-based curricula.

Russell (2003) conducted a survey of ITEA members, including a selected sampling of 410 teachers, department heads, and state supervisors. Of those selected to participate, only 60 individuals responded, but 75% of that group were teachers. She found that most had at least looked through the standards and over half had compared the standards to their own curriculum. One third had participated in training. Almost everyone (93%) who completed the survey felt the standards were important. A strong majority (87%) indicated they believed the quality of the standards to be either excellent or very good. The other 13% said the standards were good. Sixty percent held that the STLs would have a significant impact on technology education.

In an unpublished Master’s thesis, MacRae (2005) studied teachers’ perceptions of the STLs in the state of Arizona. Engineering and design was introduced through and form a part of those standards. Therefore, by extension, McRae’s study can be viewed as a study of the acceptance of technology and engineering.

McRae asked, “Now that the Standards for Technological Literacy have been in the hands of educators, administrators, and state supervisors for a little over five years, what impact have they had on technology teachers and their programs?” He explains the difference between standards and curricula, and goes on to make a strong case for better in-service. The survey conducted by Utah State University (Reeve, 2002) provided the framework in the development of the Arizona survey.

McRae concluded that the results of his survey were largely consistent with prior studies. The respondents were highly supportive of K-12 content standards of the study of technology. Almost all teachers (95.4%) would benefit from additional training related to the standards. Most teachers (90.8%) felt that their own educational background and experience had adequately prepared them to teach the five major categories identified in the STLs. McRae went on to recommend that the study be repeated periodically, and that a variety of measures be instituted, enabling researchers to triangulate their findings.

In addition to the STLs, pre-engineering coursework has also been studied. Project Lead the Way (PLtW) is the nation's premiere pre-engineering curriculum (McVeary, 2003) for secondary education. In a recent study, Rogers (2006) evaluated teachers' perceptions of the effectiveness of PLtW in the state of Indiana. Rogers developed a survey instrument based on 14 competencies addressed through the PLtW curriculum. PLtW teachers were asked to rate their perception of the effectiveness of PLtW course learning activities in developing pre-engineering competencies in their students. The ratings were on a five-point Likert-type scale. The population and sample for this study consisted of 76 technology education teachers who had completed PLtW professional development institute at Purdue University and were currently teaching PLtW courses in Indiana. Thirty-four (44.7%) of the selected teachers responded.

Rogers concluded that Indiana's PLtW teachers perceive the PLtW curriculum as being "effective" to "very effective" in developing pre-engineering competencies in their high school students. Rogers findings supports those of Bottoms and Anthony (2005) that indicated PLtW students were receiving effective high school instruction based on effective curriculum and engaging learning activities.

Chronologically the earliest of the studies reviewed, Berrett (1999) remains the strongest influence on this study. Using the Stages of Concern Questionnaire (SoCQ), Berrett surveyed industrial arts and technology education teachers in Utah junior high schools and high schools. He directed his efforts towards a better understanding of the level of acceptance among technology education teachers of technology education itself. At the time of his study, the ITEA had changed its name, but the STLs had not yet been released. Berrett strove to determine to what degree a conversion to teaching technological literacy had or had not taken root.

Berrett found that Utah's technology education teachers were in the "early stages of a change effort". His study showed that 18% of the respondents were not concerned about the innovation. They predominantly (22%) had high concerns in Stage 2 (Personal) which indicates that teachers "perceive the innovation as a personal threat". They seem to have "self doubts" about the innovation and perhaps a "lack of confidence in it." The teacher's second highest concern (14%) was in Stage 3 (Management) stage. This is "indicative of intense concerns about what the innovation entails". The balance of the responses was spread out among the stages of an advancing user including Consequence, Collaboration, and Refocusing stages. Since the primary and secondary peaks concerns of technology teachers in the state of Utah indicate "non-use", he rejected his null hypothesis that "teachers perceive technology education as a positive educational innovation and accepting it by implementing the change within the field of industrial arts." Berrett noted that the data indicated teachers "wanted to learn more about the innovation", and that some were already "inexperienced users" with "high concerns in coordination, logistics, and time that is consumed by the user in relation to the innovation."

Berrett (2005) presented some preliminary data to the Mississippi Valley Technology Teachers Conference. Drawing his information from his experience following a CTTE list-serve, he mentioned that he "had never seen another topic generate so much response". After conducting a review of that discussion thread, he developed his survey instrument. Unlike the methodology he used while doing the research for his Master's thesis, this time he conducted a nationwide internet survey utilizing an instrument of his own design. He sought to understand how the teachers were reacting to the emphasis on engineering.

His conclusions, although preliminary, are that a "majority of the technology education teachers who responded to his survey are in favor of embracing engineering education to some degree in the technology education curriculum" and "It appears that a smaller majority favor the idea of including engineering education into the overall goals of technological literacy as opposed to replacing the curriculum or having it co-exist in a parallel track". A significant number, 15% of the respondents, appear to be resistant to dealing with engineering at all.

2.5 Conclusions

A shift from industrial arts to technology education began in the late 1980's. The transition to technology education was strengthened considerably by the introduction of the Standards of Technological Literacy by the International Technology Education Association in 2000. However, the issue of whether or not to include engineering and design, or to what degree it should be included, remains an issue.

Research has been conducted in various regions to determine whether or not teachers are accepting the move to technology education, whether or not the standards are being implemented, and whether or not a pre-engineering curriculum like Project Lead the Way effectively meets the objectives. It is not understood to what degree the practice in classrooms conforms to the objectives established by leaders in the field. Central to the issue is the level of in-service training being delivered to the educators, the competencies they bring to the classroom, and their willingness to develop new curricula.

With a decade of experience with the STLs behind us and the benefit of the research conducted up until now, there is now a strong opportunity to take a second look at the progress we have made since then and to draw some comparisons. A study evaluating the acceptance among Utah's technology education teachers of engineering would be clearly justified.

3 Methods and Procedures

3.1 Statement of Procedures

The purpose of this study is to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in technology and engineering education. A review of the literature revealed four potential measurement techniques.

1. Stages of Concern Questionnaire (SoCQ), Hall, et. al., 1979, as adapted by Rogers (1989, 1991, 1992) and Linnell (1992)
2. Transition Assessment Inventory (TIA), Dyrenfurth, et. al., (1993)
3. Characteristic of Technology Education Survey (CTES), Hill, et. al., (1996)
4. Custom surveys like Smallwood (1987), Milliken (1995), Reeve, et al. (2002), or McRae (2005)

After reviewing the research objectives and measurement techniques of the primary authors, the SoCQ was selected as the most appropriate instrument for achieving the needs of this study. Berrett (1999) also chose to use the SoCQ for his study of the acceptance of technology education by technology education and industrial education teachers in Utah.

The SoCQ is based on the hypothesis that people progress through a series of seven stages of concern as they adapt to an innovation. "Concerns about innovations appear to be developmental in that earlier concerns must first be resolved (lowered in intensity) before later concerns emerge (increase in intensity)" (Hall, et. al., 1979, 6). This theory parallels that of Maslow to the extent that some needs precede others, establish a ranked order, and move from "physiological, safety, love, esteem, and self actualization" (Mook, 1987, 516). Detail for each Stage of Concern are provided in Figure 3-1: Stages of Concern Definitions.

IMPACT	**6**	Refocusing	The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.
	5	Collaboration	The focus is on coordination and cooperation with others regarding use of the innovation.
	4	Consequence	Attention focuses on impact of the innovation on students in her/his immediate sphere of influence. The focus on relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.
TASK	**3**	Management	Attention is focused on the processes and tasks of using the innovation and the best use information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.
SELF	**2**	Personal	Individual is uncertain about the demands of the innovation, her/his inadequacy to meet those demands, and her/his role with the innovation. This includes analysis of her/his role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.
	1	Informational	A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about herself/himself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects and requirements for use.
	0	Unconcerned	Little concern about or involvement with the innovation is indicated.

Note: Taken from Measuring Implementation in Schools: The Stages of Concern Questionnaire (p. 8) by A. A. George, G.E. Hall, and S. M. Stiegelbauer. Reprinted with permission.

Figure 3-1: Stages of Concern Definitions

3.2 Research Design

The SoCQ was developed over a thirteen year period (1963-1976) through pilot testing and "cross-sectional and longitudinal studies of 11 different educational innovations" by Fuller, Hall, George, Rutherford and other researchers (Hall, 1979, 10). He mentions "expert judge ratings, rated interview tapes, data analysis, and extensive dialog and interaction from the project staff and participants". As a result of these efforts, the authors were confident that "the SoC Questionnaire accurately measures stages of concern about the innovation" (Hall, 1979, 10) and a "high internal reliability was assured" (Hall, 1979, 11).

A manual titled "Measuring Implementation In Schools: The Stages of Concern Questionnaire" was obtained from the University of Texas at Austin. The manual outlines procedures for administering and interpreting the instrument. These instructions were closely observed throughout this study. The instrument presented therein was used as intended with the substitution of the name "technology and engineering education" in place of the terms "innovation", "this approach", and "the new system". Permission to use and modify the instrument and to publish related charts was obtained from Dr. Archie A. George, PhD.

The manual explains that the Stages of Concern Questionnaire (SoCQ) has three parts; an introductory page (Appendix B: SoCQ Introduction Page); a main body of thirty-five statements, or items, for the respondent to evaluate (Appendix C: SoCQ Survey Items); and a final section containing free response questions and demographic information (Appendix D: Additional Questions). The instrument may be administered in person, by mail, or through computer or internet tools.

The main body of the questionnaire consists of 35 statements carefully selected according to concerns theory to represent the seven fundamental Stages of Concern. There are five statements for each stage. Responses are given to each question on a 0-7 Likert scale according to how true the item seems at the present time. A “0” represents “irrelevant”. A “1” represents “not true of me now” and a “7” represents “very true at this time”. Examples of statements for each Stage of Concern follow:

Stage 0 (Awareness)

Q21. I am preoccupied with things other than an emphasis on engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 1 (Informational)

Q14. I would like to discuss the possibility of using engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 2 (Personal)

Q28. I would like to have more information on time and energy commitments required by emphasizing engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 3 (Management)

Q16. I am concerned about my ability to manage all that an emphasis on engineering requires.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 4 (Consequence)

Q11. I am concerned about how an emphasis on engineering affects technology education students.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 5 (Collaboration)

Q05. I would like to help other faculty in their use of engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Stage 6 (Refocusing)

Q20. I would like to revise the approach to emphasizing engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

3.3 Scoring Procedure

Scoring is accomplished by first reorganizing the response data such as is found in Table 3-1: SoCQ Individual Raw Scores into Stage of Concern groups according to the groups shown in Table 3-2: Stage of Concern & Item Correlation. An example of this grouping can be observed by comparing the collected data in Table 3-1: SoCQ Individual Raw Scores with the reorganized data in Table 3-3: SoCQ Raw Scores Grouped by Stages of Concern. The data for which corresponds with Stage 4 is shaded in gray to help illustrate the reorganization.

Table 3-1: SoCQ Individual Raw Scores

Respondent ID	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18
aga6EptgThfKQQc	4	4	4	7	4	4	4	4	3	6	4	3	7	5	6	4	6	4

Respondent ID	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35
aga6EptgThfKQQc	4	5	4	4	1	5	4	5	5	6	7	7	5	5	6	7	5

Table 3-2: Stage of Concern & Item Correlation

Stages of Concern		Items
S0	Unconcerned	3, 12, 21, 23, 30
S1	Informational	6, 14, 15, 26, 35
S2	Personal	7, 13, 17, 28, 33
S3	Management	4, 8, 16, 25, 34
S4	Consequence	1, 11, 19, 24, 32
S5	Collaboration	5, 10, 18, 27, 29
S6	Refocusing	2, 9, 20, 22, 31

Table 3-3: SoCQ Raw Scores Grouped by Stages of Concern

	S0					S1					S2				
Respondent ID	Q03	Q12	Q21	Q23	Q30	Q06	Q14	Q15	Q26	Q35	Q07	Q13	Q17	Q28	Q33
aga6EptgThfKQQc	4	3	4	1	7	4	5	6	5	5	4	7	6	6	6

	S3					S4					S5					S6				
Respondent ID	Q04	Q08	Q16	Q25	Q34	Q01	Q11	Q19	Q24	Q32	Q05	Q10	Q18	Q27	Q29	Q02	Q09	Q20	Q22	Q31
aga6EptgThfKQQc	7	4	4	4	7	4	4	4	5	5	4	6	4	5	7	4	3	5	4	5

Once the data is grouped into individual stages, it is then possible to develop stage scores by calculating the sum of the data for each stage. Table 3-4: SoCQ Stage Scores continues the example.

Table 3-4: SoCQ Stage Scores

Respondent	Stages of Concern Scores						
ID	S0	S1	S2	S3	S4	S5	S6
aga6EptgThfKQQc	19	25	29	26	22	26	21

The data is then converted to a percentile based on a scale provided in the SoCQ manual. Table 3-5: SoCQ Percentile Conversion Chart provides a breakdown of that data. The percentiles are based on the responses of 830 individuals who completed the 35-item questionnaire in the fall of 1974. The individuals were a carefully selected, stratified sample, from both elementary schools and higher education institutions, who had a wide range of experience with the innovation of teaming or modules. The percentiles have been proven to be representative of other innovations. Once the SoCQ scores are converted to percentiles, the acceptance and use patterns of the individual and the average for the group can then be inferred (George, 2006, 11-22).

The final step is a simple matter of cross-referencing the Stage of Concern with the associated stage score on the percentile conversion chart. The process is repeated for each Stage of Concern. An example of a completed profile is shown in Table 3-6: SoCQ Percentile Scores. Once this process is completed for each individual, interpretation of the data can begin.

Table 3-5: SoCQ Percentile Conversion Chart

	-- PERCENTILE SCORES --						
	S0	S1	S2	S3	S4	S5	S6
0	0	5	5	2	1	1	1
1	1	12	12	5	1	2	2
2	2	16	14	7	1	3	3
3	4	19	17	9	2	3	5
4	7	23	21	11	2	4	6
5	14	27	25	15	3	5	9
6	22	30	28	18	3	7	11
7	31	34	31	23	4	9	14
8	40	37	35	27	5	10	17
9	48	40	39	30	5	12	20
10	55	43	41	34	7	14	22
11	61	45	45	39	8	16	26
12	69	48	48	43	9	19	30
13	75	51	52	47	11	22	34
14	81	54	55	52	13	25	38
15	87	57	57	56	16	28	42
16	91	60	59	60	19	31	47
17	94	63	63	65	21	36	52
18	96	66	67	69	24	40	57
19	97	69	70	73	27	44	60
20	98	72	72	77	30	48	65
21	99	75	76	80	33	52	69
22	99	80	78	83	38	55	73
23	99	84	80	85	43	59	77
24	99	88	83	88	48	64	81
25	99	90	85	90	54	68	84
26	99	91	87	92	59	72	87
27	99	93	89	94	63	76	90
28	99	95	91	95	66	80	92
29	99	96	92	97	71	84	94
30	99	97	94	97	76	88	96
31	99	98	95	98	82	91	97
32	99	99	96	98	86	93	98
33	99	99	96	99	90	95	99
34	99	99	97	99	92	97	99
35	99	99	99	99	96	98	99

Table 3-6: SoCQ Percentile Scores

Respondent	Stages of Concern Percentiles						
ID	S0	S1	S2	S3	S4	S5	S6
aga6EptgThfKQQc	97	90	92	92	38	72	69

3.4 Data Interpretation

By design, the seven points underpinning the research question of this thesis directly parallel the seven stages of concern addressed by the SoCQ. The SoCQ data can be interpreted using three different techniques to characterize the teachers' concerns regarding engineering: (1) peak stage scores, (2) primary and secondary high stage scores, and (3) profile interpretation.

3.4.1 Peak Stage Score Interpretation

The simplest interpretation of the data is an analysis of the highest stage score, or peak stage score. This method of interpretation establishes the individual's primary stage of concern along the stages of concern axis. It is an indication of the level of development that an individual has experienced with the innovation. Table 3-7: Example of SoCQ Peak Score Analysis represents the percentile scores of ten individuals. In each case, their peak score is shaded in gray. To better interpret this data, a histogram may be created to illustrate the total number of occurrences per stage.

Table 3-7: Example of SoCQ Peak Score Analysis

Respondent ID	Stages of Concern Percentiles						
	S0	S1	S2	S3	S4	S5	S6
aga6EptgThfKQQc	97	90	92	92	38	72	69
b7vGEeM94MH5Lwg	99	96	91	94	76	36	96
e5O3sfovWE5iWRm	91	80	80	73	21	72	38
eQbP4NXTS4I1Tko	87	69	67	39	19	68	38
e5wiqIt0XEMwBy4	97	48	28	73	13	14	26
1TdzQzrtQo2O028	99	75	83	83	19	31	47
5uNm3b7Mb8x9FGY	99	60	59	73	19	28	38
czRxwLYRSFAscK0	99	98	97	88	59	64	98
b332TR6le3bkFIG	61	98	99	83	71	88	73
e8TvmnYPXIR4H88	91	96	83	52	24	25	30

3.4.2 Primary and Secondary High Stage Score Interpretation

Primary and secondary high stage score interpretation better illuminates the range of concerns that teachers may have. In many cases, the second highest Stage of Concern is equivalent or within a few percentage points of the peak stage already identified. By analyzing both the first and second highest stage scores together, better perspective is gained on the range of an individual’s strong concerns. Table 3-8: Example of SoCQ Primary and Secondary High Score Analysis presents the same data as was shown in Table 3-7: Example of SoCQ Peak Score Analysis, only this time the highest percentile score is shaded in black; the second highest stage scores are shaded in gray. To use this data, an individual’s second highest stage score is identified and categorized based on that same individual’s high stage score. The total of all secondary high score stage responses by high stage score is then recorded in a table. Secondary scores may be plotted using a three-dimensional histogram which allows for more detailed analysis of the data. Note: the total number of secondary scores for each stage is equivalent to the peak stage score analysis data.

Table 3-8: Example of SoCQ Primary and Secondary High Score Analysis

Respondent ID	Stages of Concern Percentiles						
	S0	S1	S2	S3	S4	S5	S6
aga6EptgThfKQQc	97	90	92	92	38	72	69
b7vGEeM94MH5Lwg	99	96	91	94	76	36	96
e5O3sfovWE5iWRm	91	80	80	73	21	72	38
eQbP4NXTS4l1Tko	87	69	67	39	19	68	38
e5wiqlt0XEMwBy4	97	48	28	73	13	14	26
1TdzQzrtQo2O028	99	75	83	83	19	31	47
5uNm3b7Mb8x9FGY	99	60	59	73	19	28	38
czRxwLYRSFAscK0	99	98	97	88	59	64	98
b332TR6le3bkFlG	61	98	99	83	71	88	73
e8TvmnYPXIR4H88	91	96	83	52	24	25	30

KEY
Primary = Black
Secondary =Gray

3.4.3 Profile Interpretation

Profile interpretation examines the percentile scores for all seven stages of the SoCQ in a holistic manner. When using the information provided in the accompanying manual, the resulting data provide a “rich clinical picture” that can be used to interpret the meaning of the percentage scores and their interrelationships (Hall, 2006, 37). Profile interpretation is best accomplished by reducing the data for an individual as shown in gray in Table 3-9: Example of SoCQ Profile Data to a graph like the one shown in Figure 3-2: Example of SoCQ Profile Analysis.

Table 3-9: Example of SoCQ Profile Data

Respondent ID	Stages of Concern Percentiles						
	S0	S1	S2	S3	S4	S5	S6
aga6EptgThfKQQc	97	90	92	92	38	72	69
b7vGEeM94MH5Lwg	99	96	91	94	76	36	96
e5O3sfovWE5iWRm	91	80	80	73	21	72	38
eQbP4NXTS4l1Tko	87	69	67	39	19	68	38
e5wiqIt0XEMwBy4	97	48	28	73	13	14	26
1TdzQzrtQo2O028	99	75	83	83	19	31	47
5uNm3b7Mb8x9FGY	99	60	59	73	19	28	38
czRxwLYRSFAscK0	99	98	97	88	59	64	98
b332TR6le3bkFlG	61	98	99	83	71	88	73
e8TvmnYPXIR4H88	91	96	83	52	24	25	30

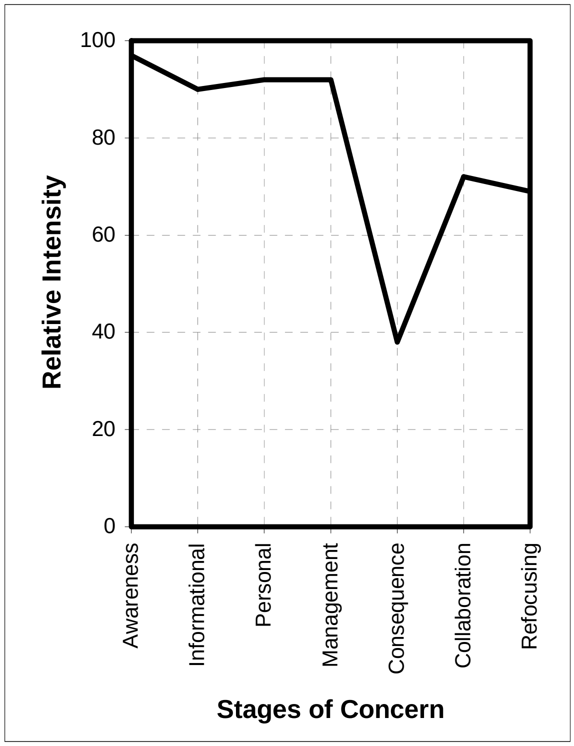

Figure 3-2: Example of SoCQ Profile Analysis

3.5 Questions Defining "Engineering"

Because the term "engineering" means different things to different people, participants are asked to answer the following open-ended question before completing the main body of the SoCQ:

Q00. How would you define "engineering"?

Responses to this question will be evaluated and placed into the categories that emerge as reoccurring themes during that analysis.

Immediately after finishing their evaluation of the 35 SoCQ items, participants are asked to respond to the following question:

Q91. In your opinion, a technology and engineering course taught to secondary education students must include: *check all that apply*

- ☐ problem solving
- ☐ the creation of technical drawings
- ☐ prototyping
- ☐ real world constraints
- ☐ physics
- ☐ higher level mathematics
- ☐ predictive analysis
- ☐ optimization
- ☐ other
- ☐ none of the above

Each participant is required to answer this question before moving on to the demographic questions. Asking the participants to respond to these two questions is an attempt to identify any bias towards a priority on skills training or the development of technological literacy. Chi-square testing will also be conducted on the responses to check for possible correlation with the respective Stages of Concern.

3.6 Population and Sampling

This study focuses on all public education teachers in the State of Utah with a technology and engineering education certification who were teaching secondary education courses within that discipline. A complete listing was developed with the assistance of the Utah State Office of Education and its CACTUS database. An analysis of class content titles and descriptors was made in order to distinguish between technology and engineering education and trade and technology teachers. Due to the wide ranging scope of the course and because certification requirements that apply to it are less specific than other technology and engineering courses, teachers with only an Introduction to CTE course (CIP Code 130001) were deliberately excluded from the list. A list of included courses is found in Table 3-10: USOE Technology & Engineering Courses.

Table 3-10: USOE Technology & Engineering Courses

CIP Code	Course Title
210102	Exploring Technology
210104	Foundations of Technology
210105	Physics with Technology
210106	Physics with Technology 2
210107	Industrial and Agricultural Technology
210108	Introduction to Communications Technology
210109	Introduction to Construction Technology
210110	Introduction to Manufacturing Technology
210111	Introduction to Transportation and Energy Technology
210112	Advanced Technology Education
210114	Pre-engineering Technology
210115	Engineering Design
210116	Materials and Processes
210120	Introduction to Engineering Design - PLTW
210121	Digital Electronics - PLTW
210122	Principles of Engineering - PLTW
210123	Computer Integrated Manufacturing - PLTW
210124	Engineering Design and Development - PLTW
210125	Civil Engineering and Architecture - PLTW

Using this procedure, 291 certified teachers were identified who were actively teaching at least one technology and engineering education course during the 2008-2009 school year. That population was composed of 157 (53.95 %) middle school/junior high school teachers and 134 (46.05%) high school teachers. It included 29 (9.97%) female and 262 (90.03%) male teachers. The aggregate of full-time enrollment (FTE) for the CTE courses of concern for all 291 teachers is listed in Table 3-11: Population FTE Totals by Courses Taught.

Table 3-11: Population FTE Totals by Courses Taught

Course Name	CIP Code	Population FTE			
		Jr High		Sr High	
Exploring Technology	210102	48.05	30.57%	2.62	1.67%
Foundations of Technology	210104	3.95	2.51%	7.28	4.63%
Introduction to Communications Technology	210108	6.86	4.36%	1.27	0.81%
Introduction to Construction Technology	210109	8.43	5.36%	2.54	1.62%
Introduction to Manufacturing Technology	210110	22.91	14.58%	4.40	2.80%
Introduction to Transportation and Energy Technology	210111	1.10	0.70%	0.10	0.06%
Industrial and Agricultural Technology	210107			1.24	0.79%
Physics with Technology	210105	1.92	1.22%	21.11	13.43%
Physics with Technology 2	210106			0.35	0.22%
Advanced Technology Education	210112			1.67	1.06%
Pre-engineering Technology	210114			2.40	1.53%
Engineering Design	210115			0.16	0.10%
Materials and Processes	210116			0.33	0.21%
Introduction to Engineering Design - PLtW	210120			4.92	3.13%
Digital Electronics - PLtW	210121	0.24	0.15%	3.20	2.04%
Principles of Engineering - PLtW	210122			5.91	3.76%
Computer Integrated Manufacturing - PLtW	210123			1.25	0.80%
Engineering Design and Development - PLtW	210124			2.26	1.44%
Civil Engineering and Architecture - PLtW	210125			0.69	0.44%

Requests to conduct research were submitted to the individual holding the authority to grant that approval in each district. In most cases, that was the CTE Coordinator. In the larger districts, there was generally a formal application process. The smaller districts often gave verbal approval over the telephone or returned an e-mail. Thirty-six of the thirty-eight school districts in the Sate of Utah allowed surveys to be sent to their teachers. Of the two districts who elected not to participate, one had set a moratorium based on their feeling that their teachers were being subjected to too many research projects, the second could not complete the approval process before a regularly established moratorium period at the end of each semester. One district was small and the other large. A comparison of the demographics of the overall population to that of the remaining group revealed no significant shifts in balance.

Survey invitations were sent to 255 teachers. Of the 36 participating districts, teachers from 26 districts (72.2%) responded. Of the 255 invitations, 135 surveys were started and 106 (36.4% of the overall population, 41.6% of those surveyed) were completed and returned.

Of the 106 teachers who responded, 54 (50.9%) taught at a middle school or a junior high school and 52 (49.1%) taught at a high school. Surveys were completed by 13 (12.3%) females and 93 (87.7%) males.

In order to verify that the results were a fair representative of the population, a comparison of gender ratio, school types, and class distribution was made between that of the population and that of the sample. The ratios of both male to female teachers and middle school/junior high school teachers to high schools teachers is comparable and can be seen in the following three tables: Table 3-12: Population and Sample School Level Comparison, Table 3-13: Population and Sample Gender Comparison and Table 3-14: Population and Sample District Classification Comparison, respectively.

Table 3-12: Population and Sample School Level Comparison

Gender	Population *n*	Population %	Sample *n*	Sample %
Female	29	10.0%	13	12.3%
Male	262	90.0%	93	87.7%

Table 3-13: Population and Sample Gender Comparison

School Level	Population *n*	Population %	Sample *n*	Sample %
Middle/Junior	162	55.7%	54	50.9%
Senior	129	44.3%	52	49.1%

Table 3-14: Population and Sample District Classification Comparison

District Class as % of FTE	Population *n*	Population %	Sample *n*	Sample %
A (0.00-0.49%)	7	2.4%	4	3.8%
B (0.50-1.49%)	49	16.8%	16	15.1%
C (1.50-2.99%)	64	22.0%	22	20.8%
D (3.00-7.49%)	47	16.2%	27	25.5%
E (7.50+%)	124	42.6%	37	34.9%

FTE totals for the courses taught by the teachers who responded are shown in Table 3-15: Sample FTE Totals by Courses Taught. A comparison of the courses taught by the overall population with the courses taught by the respondents is shown in Figure 3-3: Population & Sample FTE% Comparison.

Table 3-15: Sample FTE Totals by Courses Taught

Course Name	CIP Code	Sample FTE Jr High		Sample FTE Sr High	
Exploring Technology	210102	18.83	29.86%	2.70	4.28%
Foundations of Technology	210104	1.50	2.38%	2.56	4.06%
Introduction to Communications Technology	210108	1.19	1.89%	1.09	1.73%
Introduction to Construction Technology	210109	2.42	3.84%	2.12	3.36%
Introduction to Manufacturing Technology	210110	7.15	11.34%	3.68	5.84%
Introduction to Transportation and Energy Technology	210111	0.65	1.03%		
Industrial and Agricultural Technology	210107				
Physics with Technology	210105	1.16	1.84%	8.41	13.34%
Physics with Technology 2	210106			0.17	0.27%
Advanced Technology Education	210112			0.15	0.24%
Pre-engineering Technology	210114			1.74	2.76%
Engineering Design	210115			0.16	0.25%
Materials and Processes	210116			0.24	0.38%
Introduction to Engineering Design - PLtW	210120			2.38	3.77%
Digital Electronics - PLtW	210121			0.87	1.38%
Principles of Engineering - PLtW	210122			1.32	2.09%
Computer Integrated Manufacturing - PLtW	210123			0.62	0.98%
Engineering Design and Development - PLtW	210124			1.37	2.17%
Civil Engineering and Architecture - PLtW	210125			0.58	0.92%

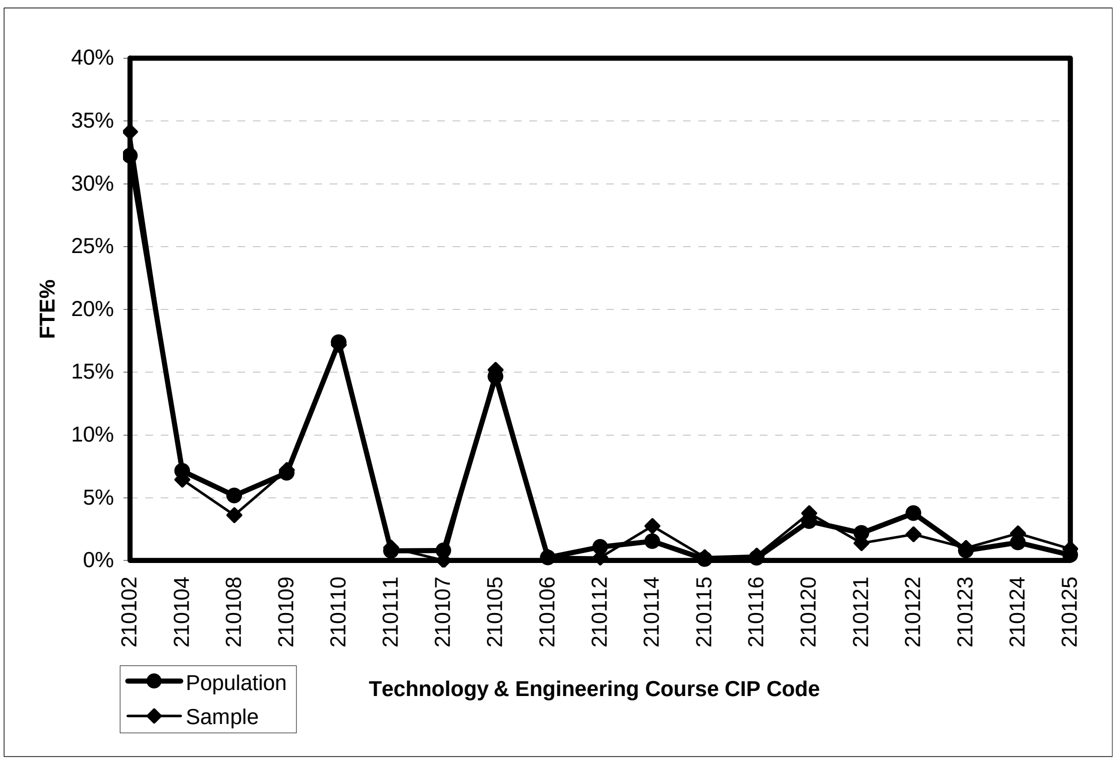

Figure 3-3: Population & Sample FTE% Comparison

Although comparative data was not available, additional demographic information is known about the sample and is shown in Table 3-16: Summary of Sample Demographics.

Table 3-16: Summary of Sample Demographics

		n	*%*
Age	20 to 29	9	8.5%
	30 to 39	30	28.3%
	40 to 49	30	28.3%
	50 to 59	29	27.4%
	60 +	8	7.5%
Teaching Experience	1 to 5	22	21.0%
	6 to 10	16	15.2%
	11 to 15	22	21.0%
	16 to 25	29	27.6%
	26 +	16	15.2%
Highest Degree Earned	Bachelors	50	47.2%
	Masters	54	50.9%
	Doctorate	2	1.9%
Professional Development	2009	46	-
	2005-2008	91	-
	2000-2004	64	-
	1995-1999	51	-
	1990-1994	29	-

Given the similarities in junior high to high school ratios, male to female respondents, comparable FTE percentages for each course, and the relative balance in other demographic information that was collected, the sample was determined to be an accurate reflection of the population.

3.7 Administrative Procedure

The survey was conducted via the internet using Brigham Young University's Qualtrics survey software license. The cooperation of the CTE Directors in the 36 participating school districts was solicited and each of the previously identified teachers was sent an e-mail explaining the importance of their participation in the study which included a hyperlink to a web-based survey form (Appendix A: Invitation Letters) on March 25th, 2009. Those failing to respond within 5 days were sent a second invitation on March 30th, 2009. Each teacher failing to respond within the next 5 days was sent a third e-mail requesting their participation on April 6th, 2009. The survey closed on April 10th, 2009. Thirty-one useable surveys were received after the first invitation, 55 after the second, and 20 after the third. Twenty-nine additional, incomplete surveys were received. They were not found to be useable and were excluded from further analysis per the instructions.

3.8 Scoring Procedure

The participants were assured their responses would be kept confidential. The Qualtrics survey software was used to automatically assign a randomly generated, fifteen-digit, alpha-numeric identification code for each respondent.

The guidelines established by "Measuring Implementation in Schools: The Stages of Concern Questionnaire" (George, et al., 2006, p.26), were followed to process the data using the MS Excel file included on the CD provided with the book. This method of scoring the SoCQ allows a mean score to be obtained for each stage of concern, the assignment of a percentile to the score, and for the individual profiles and group profiles to be plotted. The profiles provide a visual aid for interpreting the acceptance in stages as well as other analysis.

4 Results and Findings

4.1 Stages of Concern Profile Analysis

The purpose of this study is to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in technology and engineering education. The over-arching research question is: What is the level of acceptance among secondary education teachers in the State of Utah teaching technology education courses to an emphasis on engineering content in their discipline? To determine the level of acceptance of a new innovation, one instrument that can be used by researchers is the SoCQ. This instrument allows participants' concerns to be measured on a seven-stage scale. According to George (2006), high scores in the stages listed generally indicate a focus on:

Stage 0 Awareness — interest and engagement with the innovation in comparison to other tasks, activities, and efforts of the respondent.

Stage 1 Informational — gaining fundamental information about what the innovation is, what it will do, and what its use will involve.

Stage 2 Personal	ego-oriented questions and uncertainties concerned with status, rewards, and what effects the innovation might have on them.
Stage 3 Management	intense concerns about management, time, and logistical aspects of the innovation.
Stage 4 Consequence	the innovation's impact on students, including performance and competencies and the changes needed to improve student outcomes.
Stage 5 Collaboration	cooperating and coordinating with others regarding the use of the innovation.
Stage 6 Refocusing	exploring ways to reap more universal benefits from the innovation including making major changes or replacing it with a more powerful alternative.

The SoCQ allows researchers to determine what stage the participants are in as they move from just learning about an innovation to total acceptance of the innovation. In this research study, the SoCQ was used to determine Utah technology and engineering teachers' level of acceptance regarding the following research points:

1. the priority on engineering in their course content
2. learning more about engineering
3. the process of learning more about engineering
4. developing strategies for implementing engineering content

5. how the addition of engineering content will affect their students
6. collaborating with their peers to develop engineering content
7. exploring alternative ideas to an emphasis on engineering

Each one of the points underpinning the research question is directly related to one of the seven stages of concern. The manual presents several techniques for interpreting the data including peak stage score interpretation, first and second stage score interpretation, and profile interpretation.

4.2 Peak Stage Score Interpretation

The simplest form of interpretation is to identify the highest stage score. A histogram detailing the peak stages of concern for each respondent is shown in Figure 4-1: Peak Stage of Concern Histogram. This method provides a general overview of how the group is distributed along the Stages of Concern continuum.

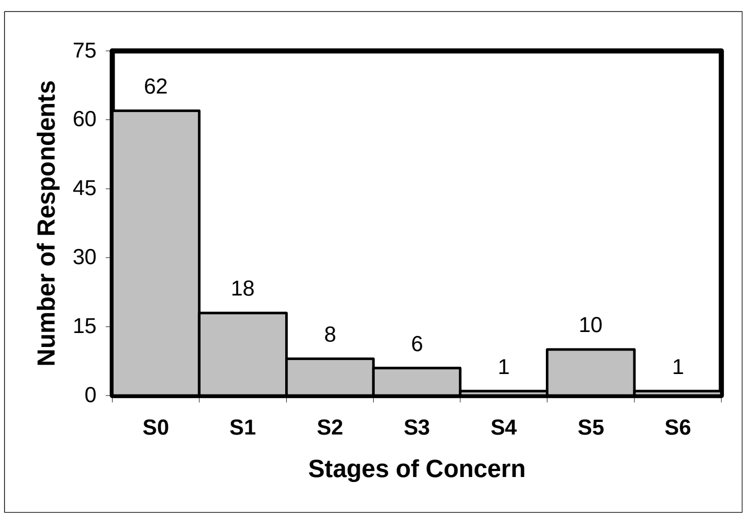

Figure 4-1: Peak Stage of Concern Histogram

The data collected from the 106 participants in the study show an overwhelming majority of Stage 0 (Awareness) peak responses. This suggests the majority (58.5%) of technology and engineering education teachers in the State of Utah have “little concern or involvement with the innovation”. Stage 0 scores provide an indication of the degree of priority the respondent is placing on the innovation and the relative intensity of concern about the innovation, in this case an emphasis on engineering content in their curriculum. Stage 0 does not provide information about whether or not the respondent is a user or nonuser; instead Stage 0 addresses the degree of interest in and management with the innovation in comparison to other tasks, activities, and efforts of the respondent (George, 2006, 33). The higher the Stage 0 score, the more the respondent is indicating that there are a number of other initiatives, tasks, and activities that are of greater concern to him or her. In other words, the innovation is not the only thing the respondent is concerned about. This provides data that helps answer research point #1 regarding teachers’ concern about the addition of engineering content to their courses.

While Stage 0 scores are the highest, it is interesting to note the information provided by looking at the scores of the other stages. Of particular interest is the comparability of the other stages and the smaller peak at Stage 5 (Collaboration). The SoCQ authors hypothesize that a person progresses through each stage in sequence. When viewed over time, the data is then seen to follow something of a wave pattern moving left to right. That being the case, you would expect to see a surge building to the right of the highest stage as the group progresses. Stage 5 is unique in the respect that it stands alone as a small "spike" in the data, the stages to the left and right each being relatively low. In fact, Stage 4 (Consequence) and Stage 6 (Refocusing) are the lowest overall. This data helps answer research point #6, suggesting the existence of a group of teachers who have embraced the change and are primarily concerned with "coordinating and cooperating with others regarding use of the innovation" (George, 2006, 8).

4.3 Primary and Secondary High Stage Score Interpretation

Primary and secondary high stage score interpretation offers a broader picture of the data by providing visibility to scores other than just the peak score. This is important to investigate because the secondary scores may be almost as high as the score for the primary concern and deserve consideration. In addition, knowing the secondary concern provides insight into whether or not the primary concern is building or waning. If the secondary concern is a lower stage, the primary concern is considered to be building; if higher, it is thought to be waning. First and second high stage scores are shown in Table 4-1: Secondary High Score Stage of Concern Data and are illustrated in Figure 4-2: Secondary High Score Stage of Concern Histogram.

Table 4-1: Secondary High Score Stage of Concern Data

Secondary \ Primary	S0	S1	S2	S3	S4	S5	S6
S0	-	5	2	1	1	3	0
S1	24	-	5	2	0	5	0
S2	17	4	-	2	0	2	0
S3	17	3	0	-	0	0	0
S4	0	0	0	0	-	0	0
S5	2	4	1	0	0	-	1
S6	2	2	0	1	0	0	-
Total	62	18	8	6	1	10	1

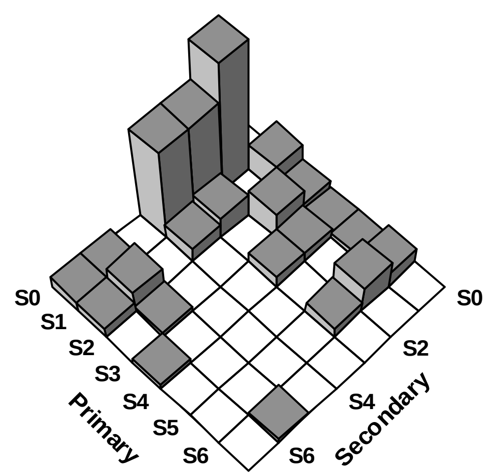

Figure 4-2: Secondary High Score Stage of Concern Histogram

Once again, the data reflects a primary concentration of concerns in the earliest stages with Stage 0 (Awareness) dominating all others and a smaller island of concern at Stage 5 (Collaboration). The data shows that more than just a dominant concern at Stage 0, the respondents have an associated cluster of concerns at Stages 1 (Informational), 2 (Personal), and 3 (Management).

It should be noted that Stage 1 and Stage 2 scores are often similar. George (2006) acknowledges, “In many SoCQ studies, researchers have found high correlations between Stage 1 and Stage 2 scores, leading them to advocate combining these into one stage (Bailey & Palsha, 1992; Cheung, Hattie, Ng, 2001; Shotsberger & Crawford, 1999). During the development of the original SoCQ, the authors also found high correlations between these two scales. Work with individual Stages of Concern profiles, however, demonstrated that there was a clear distinction between the two scales for certain individuals. The CBAM research team eventually concluded that the concepts of Informational and Personal concerns are indeed distinct, even though they often occur at the same time, and respondents with higher concerns on other stages often simultaneously have low scores for both Stage 1 and Stage 2.” The strong secondary scores in Stages 1 through 3 helps answer the research points #2, #3, and #4, suggesting the teachers have significant interest in learning more about engineering, how it will affect them personally, and how it can be implemented in their classes.

Of particular note is the conspicuous absence of either primary high stage or secondary high stage responses at Stage 4 (Consequence) which addresses the teachers’ concern for how an emphasis on engineering in the classroom will affect their students. This is not to be understood to mean that the teachers do not care about their students. Rather, the contrast between the early stages and Stage 4 is an indicator that the teachers have not matured through the initial stages of “self” to the point where they can begin to think through the benefits of the innovation on their students. Early stage concerns will need to be addressed before meaningful progress can be made in this area. This information helps illuminate research point #5.

In addition to the other findings, the smaller population of teachers with a concern at Stage 5 (Collaboration) is again reinforced. The presence of a small group of teachers who are concerned about collaborating on engineering content is clearly indicated. There are teachers who have progressed through Stage 4 who could potentially be used to help mentor the teachers struggling in the early stages cross to the other side of the Stage 4 gulf. Stage 5 will be explored further in the next section, but the recognition of this smaller group at Stage 5 is the beginning to understanding research point #6.

There are a few scattered responses at Stage 6 (Refocusing), but not enough to suggest that a significant group exists who support alternative or a competing idea. However, at the end of survey, participants were asked:

Q47. Do you have any comments that you would like to offer about technology and engineering education?

All six participants (100%) with a primary or secondary Stage 6 high score offered responses to the open-ended question. Four of the respondents indicated support, albeit not explicitly, for ITEA's ideal of "Technology for All Americans". Two voiced an interest in more "vocationally" oriented programs that emphasize hands-on learning. None of the comments were understood to convey a need for a greater emphasis on engineering. Individuals with a peak or secondary score at Stage 6 would be expected have an alternative idea to an emphasis on engineering. Although not a large group, the responses were consistent with that hypothesis and support the validity of the SoCQ. Data concerning Stage 6 contributes to the understanding of research point #7.

4.4 Profile Interpretation

Analyzing the complete profile allows for the most sensitive interpretations of respondents' concerns. Peak score interpretation is limited in that it reports only the highest concerns and ignores all others. First and secondary high stage scores add some breadth to the interpretation, but the picture is incomplete until all stages are considered holistically. Whereas the SoCQ scores reported are a self-appraisal, they must be understood to be relative, meaning that the relationship between scores is more important than their absolute value. They are analogous to a Doctor asking someone how much pain they feel; one person's “5” might be another's “9” and are not comparative. However, responses comparing the pain felt in the person's leg versus that in an arm are very useful.

By performing a profile interpretation and looking at all stages of concern in relationship to one another, we have the most complete view of a teacher's concerns, information that is not easily obtained by looking at peak scores alone. This technique emphasizes relative scores over absolute values, a more accurate use of the SoCQ. A complete catalog of all 106 individual profiles is available in Appendix E: Individual SoCQ Profiles. A composite of all Utah technology and engineering education teacher SoCQ percentile means is shown in Figure 4-3: Stages of Concern Group Profile.

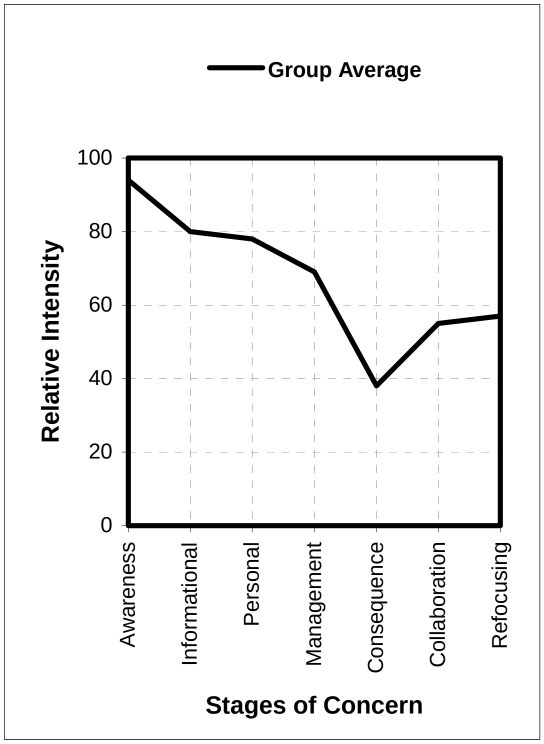

Figure 4-3: Stages of Concern Group Profile

The dominance of Stage 0 observed in the interpretations presented earlier remains clear. Roughly a dozen of the profiles follow the same general pattern established by the group average: an exceptionally high Stage 0 percentile, strong but declining Stages 1, 2, and 3, a low at Stage 4, increasing through Stages 5 and 6. Over 30 other profiles show a pronounced “ridgeline” at Stage 3, with strong scores through the early stages and a dramatic decline at Stage 4 as shown in Figure 4-4: Example of a S3 Ridge/S4 Valley Profile. Strong scores through Stage 3 indicate “strong concern about management, time, and logistical aspects of the innovation.” This interpretation coincides with the previous conclusions given for research points #1 through #4; the majority of teachers are absorbed with concerns that center on learning about the innovation and ways to implement it, leaving them little room to consider how an emphasis on engineering content would affect their students. The individual profile example shown, and all those in this study that follow, are plotted against a backdrop of group data that includes the sample group's median percentile score for each stage as well as the inner quartile range for those responses.

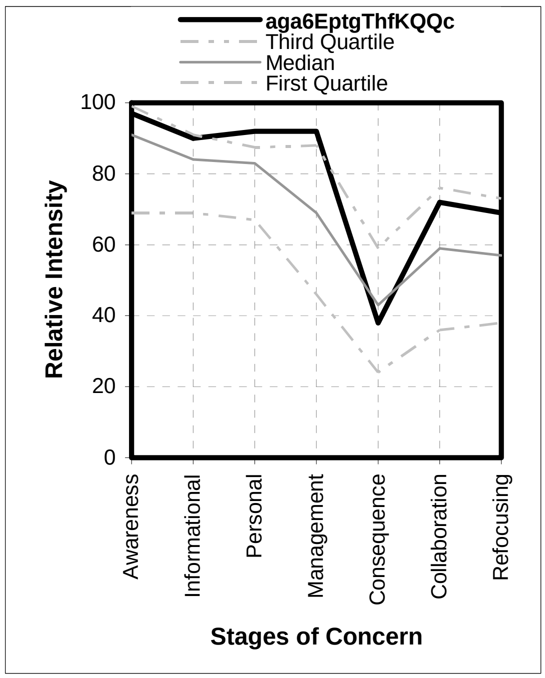

Figure 4-4: Example of a S3 Ridge/S4 Valley Profile

While the analysis suggested by George (2006) focuses mainly on the highest peaks, the majority of the profiles are marked with a distinct valley at Stage 4 (Management). Fifty of the 106 profiles (47.2%) are lowest at Stage 4. With only a single secondary high score at this point and no peak scores, the level of concern on the impact of engineering on students within the teachers' sphere of influence is interpreted to be very low. In answer to research point #5 that addresses the affect of the innovation on students, the teachers surveyed indicate a profound lack of concern for evaluating student outcomes, performance, or competencies.

Another dozen profiles show a sharp “spike” in the data at Stage 5 (Collaboration). More than just a rise and decline, these are profiles that exceed the adjacent stages by more than 20 percentage points. This feature can be seen in Figure 4-5: Example of a S5 Spike Profile. The dramatic difference in relative strength of Stage 5 to the adjoining stages suggests an unusually strong intensity of concern about this point.

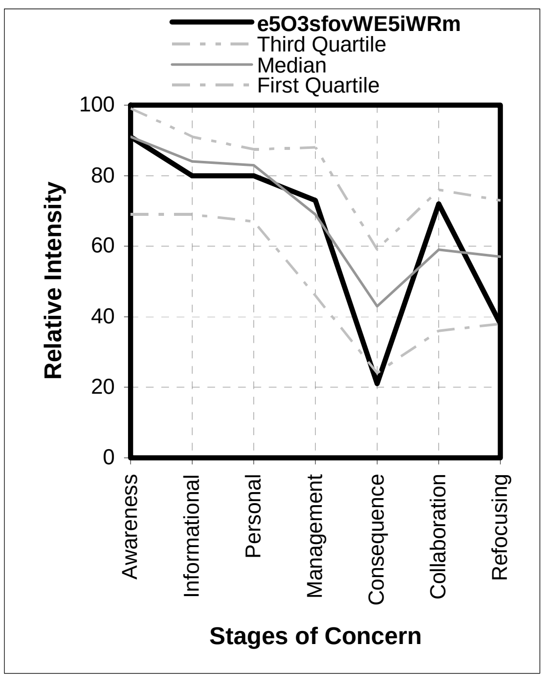

Figure 4-5: Example of a S5 Spike Profile

Profile analysis highlights an additional pattern, one that stands in direct contrast to the Stage 5 “spike”. Nineteen of the profiles are lowest at Stage 5, and eight of them reveal a significant "valley" in the data at that point. This feature can be seen in Figure 4-6: Example if a S5 Valley Profile. This segment of the continuum, the stage that addresses collaboration, appears to be the most polarized Stage of Concern. A bimodal pattern is also observed involving this stage. Many of the profiles that show a spike at Stage 5 also show a high score at Stage 1. When all of these observations are viewed together, it suggests a number of teachers want to know more and are looking to collaborate with their peers to do so. A concise answer to research point #6 cannot be made, other than to say that the field is strongly divided in its concern for cooperation and collaboration.

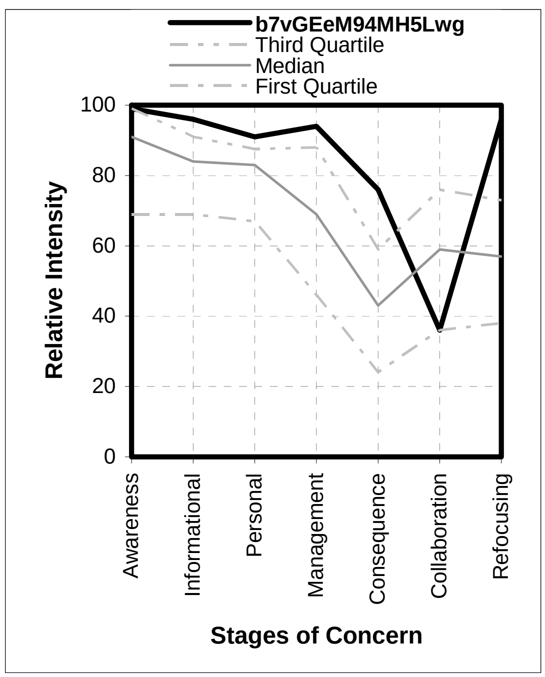

Figure 4-6: Example if a S5 Valley Profile

4.5 Questions Defining "Engineering"

Seventy-four of the 106 participants (69.8%) offered a definition of the term "engineering". Figure 4-7: Free Responses to a Definition of "Engineering" is a histogram that summarizes the responses for each of the classifications that emerged.

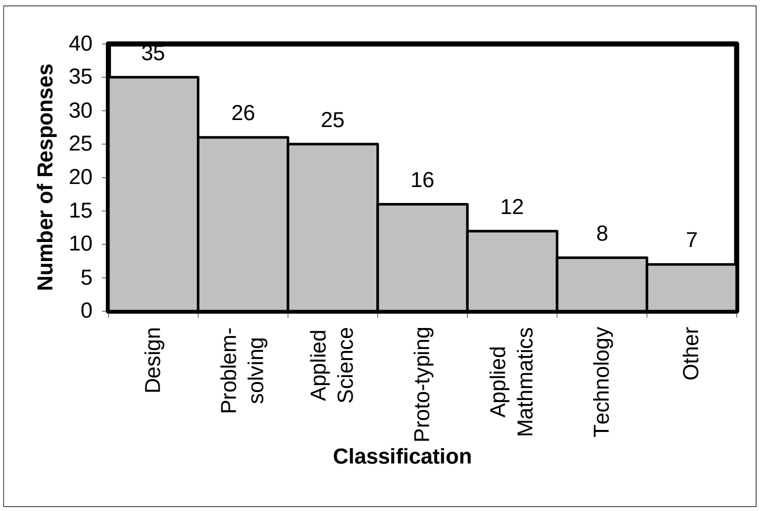

Figure 4-7: Free Responses to a Definition of "Engineering"

Following their completion of the SoCQ questions, every participant was required to answer a question identifying critical elements of an engineering course before moving on to the demographic questions. Responses to this question are shown in Figure 4-8: Responses to Mandatory Elements of an Engineering Course.

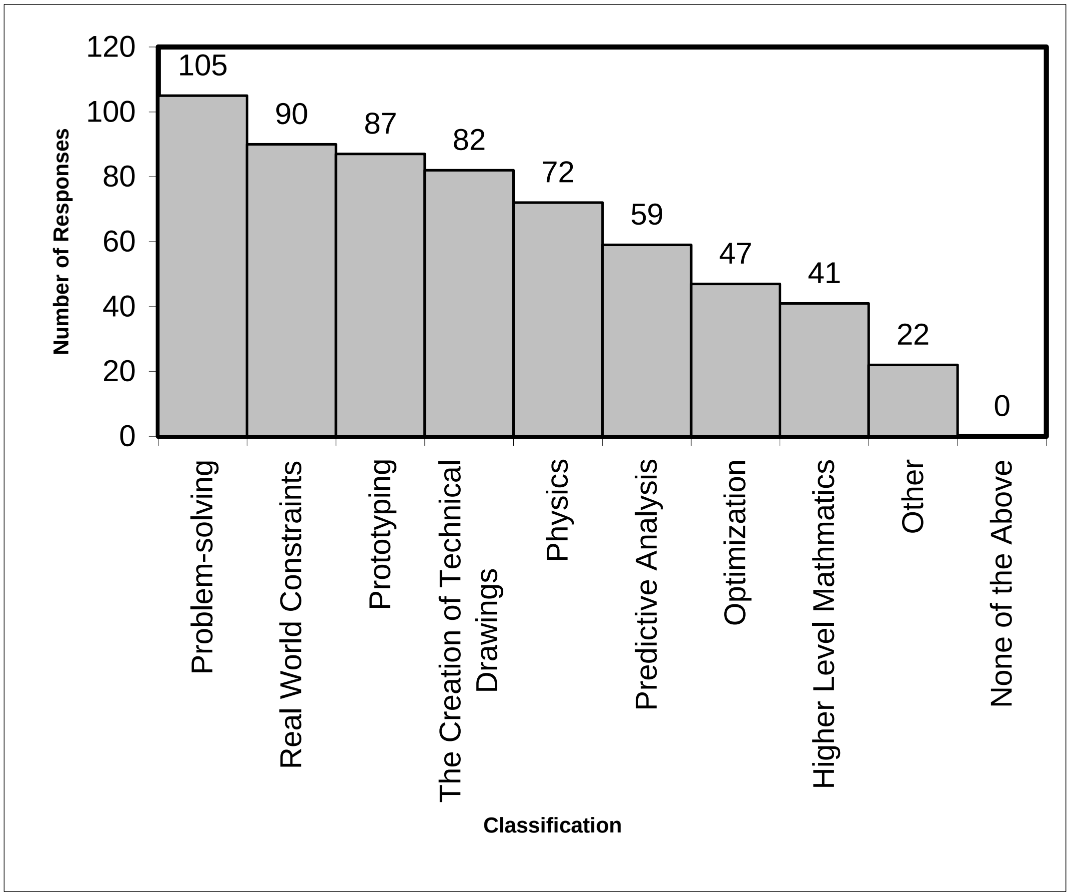

Figure 4-8: Responses to Mandatory Elements of an Engineering Course

While “design” was the most often mentioned element defining engineering in the open-ended question, only two of the 22 “other” responses made direct mention of a design cycle. Two others mentioned “redesign” and “refining”. Problem-solving ranked high and Math ranked low in the responses to both questions. Physics (Science) and Proto-typing exchanged positions in ranking of relative importance. No one mentioned constraints or technical drawing on their own, but they ranked 2nd and 4th respectively when listed in this second question.

No particular bias towards a priority on skills training or the development of technological literacy was detected in the data. Neither was a correlation found between the response to this question and an individual's Peak Stage of Concern.

4.6 Correlation Investigation

In order to determine if there were statistically significant differences in participant scores by variables such as gender, age, etc., the researcher worked with the Brigham Young University's College of Physical & Mathematical Sciences Center for Collaborative Research and Statistical Consulting to process the data. After the data was classified by high stage score and then low stage score, chi-square analysis was performed on each data set. Tests were conducted against the following variables: gender, age, teaching experience, training history, highest degree earned, type of school, type of district, courses taught (by CIP Code), definition of "engineering", and by which of the three invitation letters the teacher responded to. In each case, either the *p-value* exceeded .05 or the effective sample size was too small to yield a meaningful determination of correlation. Had a correlation been found, it may have been possible to establish a connection between that variable and the Stage of Concern. A much larger sample size would be required to advance this line of research. Lacking any indication of correlation, no further study in this area was deemed warranted.

4.7 Summary of SoCQ Data Analysis

Based on the SoCQ Profile data, the typical technology and engineering teacher in the State of Utah:

1. is much more concerned about other issues than they are about an emphasis on engineering content in the classes they teach.
2. is generally aware of the emphasis on engineering and has indicated an interested in learning more about the details of it.
3. is uncertain about engineering's demands, her/his inadequacy to meet those demands, and her/his role with engineering.
4. is only slightly less concerned about the processes and tasks associated with implementing and using engineering, placing a relatively high priority on issues related to efficiency, organizing, managing, scheduling, and time demands.
5. is least concerned about an emphasis on engineering content's impact on and relevance to students in her/his immediate sphere of influence. They are not focused on an evaluation of student performance and competencies, or changes needed to increase student outcomes.
6. has widely divergent views on collaborating and coordinating with others to develop engineering content.
7. is only moderately interested in an exploration of more universal benefits that could be derived from an emphasis on engineering including the possibility of major changes or replacement with a more powerful alternative.

5 Conclusions and Recommendations

5.1 Summary

The purpose of this study is to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in technology and engineering education. The research question is: What is the level of acceptance among secondary education teachers in the State of Utah teaching technology education courses to an emphasis on engineering content in their discipline? In order to answer that question, a standardized survey instrument entitled the Stages of Concern Questionnaire (SoCQ) was used to determine to what degree technology and engineering teachers in the State of Utah are concerned about the following research points:

1. the priority on engineering in their course content
2. learning more about engineering
3. the process of learning more about engineering
4. developing strategies for implementing engineering content
5. how the addition of engineering content will affect their students
6. collaborating with their peers to develop engineering content
7. exploring alternative ideas to an emphasis on engineering

5.2 Conclusions

Every effort has been made to maintain a high standard of quality in each aspect of this study. Instructions contained in the manual "Measuring Implementation in Schools: The Stages of Concern Questionnaire" (George, et al., 2006) for the designing and conducting the SoCQ were followed in close detail. An analysis of the demographic data was performed and it was determined that the sample is an accurate reflection of the population. The meaning of the resulting data is limited only by the genuineness of the responses and the author's interpretations.

The conclusion to the research question is a composite of the following research points.

5.2.1 Conclusion for Research Point #1

The first research point in this study was to determine if teachers placed a high priority on engineering in their course content. From the findings it was determined that a clear majority (70.8%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 0 (Awareness). It is therefore concluded that the majority of teachers are more concerned about other issues than they are about an emphasis on engineering content in the classes they teach.

5.2.2 Conclusion for Research Point #2

The second research point in this study was to determine if teachers are interested in learning more about engineering content for their courses. From the findings it was determined that a strong majority (59.4%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 1 (Informational). No one reported a low stage score for Stage 1. It is therefore concluded that while there are other factors that remain a priority, the majority of teachers are generally aware of the emphasis on engineering and have indicated an interest in learning more about the details of it.

5.2.3 Conclusion for Research Point #3

The third research point in this study was to determine if teachers are concerned about the process of learning more about engineering content that would be taught in their courses. From the findings it was determined that a significant number (41.5%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 2 (Personal). It is therefore concluded that many teachers are uncertain about the demands that are created by an emphasis on engineering content, their inadequacy to meet those demands, and their role in delivering engineering content.

5.2.4 Conclusion for Research Point #4

The fourth research point in this study was to determine if teachers are concerned about developing strategies for implementing engineering content in their courses. From the findings it was determined that a significant number (31.1%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 3 (Management). It is therefore concluded that many teachers are only slightly less concerned about the processes and tasks associated with implementing and using engineering, placing a relatively high priority on issues related to efficiency, organizing, managing, scheduling, and time demands.

5.2.5 Conclusion for Research Point #5

The fifth research point in this study was to determine if teachers are concerned how the addition of engineering content will affect their students. From the findings it was determined that no technology and engineering education teachers sampled reported a primary high stage score for Stage 4 (Consequence). Only one reported a secondary high stage score for Stage 4. Rather, a majority (52.8%) reported a low score for Stage 4. It is therefore concluded that teachers are least concerned about an emphasis on engineering content's impact on and relevance to students in their immediate sphere of influence. They are not focused on an evaluation of student performance and competencies, or changes needed to increase student outcomes.

5.2.6 Conclusion for Research Point #6

The sixth research point in this study was to determine if teachers are concerned about cooperating and collaborating with their peers to develop engineering content. From the findings it was determined that a significant group (20.8%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 5 (Collaboration). The same amount (20.8%) reported a low score for Stage 5. It is therefore concluded that teachers have widely divergent views on collaborating and coordinating with others to develop engineering content.

5.2.7 Conclusion for Research Point #7

The seventh research point in this study was to determine if teachers are concerned about exploring alternative ideas to an emphasis on engineering. From the findings it was determined that only (11.3%) of technology and engineering education teachers sampled reported a primary or secondary high stage score for Stage 6 (Refocusing). It is therefore concluded that teachers are only moderately interested in an exploration of more universal benefits that could be derived from an emphasis on engineering including the possibility of major changes or replacement with a more powerful alternative.

5.2.8 Findings Summary

Based on these seven findings, most of the technology and engineering education teachers surveyed in Utah are in the early stages of acceptance of an emphasis on engineering. The typical technology and engineering teacher is more concerned about things other than an emphasis on engineering, but is interested in learning more. They have some apprehension about the demands and just how to proceed, but do not seem to question the wisdom of moving in that direction for the benefit of their students. Some are very willing to collaborate, but an equal number do not seem to be interested in collaboration.

Significant support for a change to the current strategy or for exploring an alternative to engineering has not developed.

5.3 Implications

Although he was referring to a different innovation, the shift from industrial education to technology education, Berrett (1999, 64) wrote, “It is alarming that since the AIAA changed its name in the mid 1980’s, and the change process really began to sweep the nation, that nearly 15 years later, the implications of that technology education *means* is still undetermined.” As of this writing, another decade has passed since Berrett made that observation and nationally the field is shifting towards an emphasis on engineering. Berrett continued, “We must become unified as a profession on a field that meets the needs of society as defined by members of society, our profession’s leaders, and the teachers within”, and then, “It is important to determine teachers’ perceptions within the field in order to determine how to face the future direction and needs of the profession. If there is not a common ground attained soon between traditional industrial arts and technology education reform lines, we will be hard pressed to accomplish anything except perhaps the expiration of our profession during the next century.” Vestiges of the change Berrett studied can still be observed and face similar challenges today with this new emphasis.

Bussey, et al. (2000) cited a study conducted by Rogers and Mahler (1994), showing that the majority (775) of industrial education teachers in Nebraska did not accept the shift towards technology education. They also cited a study by Swanson (1981) that found a majority (68.8%) of teachers did not adopt the notion of technology education.

Bussey, et al. suggested that the AAIA's decision to change to the ITEA was one decided by authorities with little input from the membership. Subsequently, there was some resistance to a change from industrial arts to technology education. Several other factors were identified that contributed to a poor climate for change. They suggested that the industrial arts teachers were not properly prepared for the new curriculum and that they were unwilling to try the new program due to a lack of stable support offered from their administration in terms of having adequate budgets, facilities, and resources. A key difference between Bussey's study and the earlier studies was the introduction of the Standards for Technological Literacy. The standards provided a framework for moving forward; standards-based curriculum materials did not become available until several years afterward. The leading factor promoting adoption of technology education was shown to be a personal interest on the part of the teacher.

While specific factors contributing or inhibiting adoption of an emphasis on engineering in technology education have not been directly investigated in this study, the concerns expressed by the industrial arts teachers in New Mexico in Bussey's study closely parallel the early stages of the results from the SoCQ in this study in that the majority of the teachers are in the early stages of concern. This study agrees with Bussey in that it shows an acceptance of change that was not seen in the studies conducted by Rogers and Mahler (1994) and Swanson

(1981), however it does not suggest significant progress beyond Bussey, et al's findings (2000).

In a study conducted by Reeve, et al. (2002) of Utah junior high school technology education teachers, they found that most teachers (76%) felt the standards would help strengthen the image of technology education and would implement standards-based curriculum if available. Most (approximately 81%) felt that their own background and training had adequately prepared them to teach any of the five major categories, namely: Nature of Technology, Technology and Society, Design, Abilities for a Technological World, A Designed World. "Design" and "Abilities for a Technological World" are particularly relevant to this study in that they are essentially "engineering". These two sections within the STLs directly address standards for teaching engineering design.

A number of the open-ended responses in Reeve's survey instrument referred to a need for more in-service professional development. While the Utah teachers surveyed felt qualified to teach the categories of content, only 19% of the teachers had been in-serviced. Almost all teachers (85%) would attend training if offered. Seventy-eight percent of the respondents asserted that they were modifying their curriculum to "reflect" the standards.

The results of Reeve's study demonstrates similar findings to the results of this study in that most teachers acceptance was high and they were willing to learn more. The findings in his study suggest that the respondents had progressed to the equivalent of SoCQ Stage 3 (Management).

Nearly a decade after Jackson's Mill, but prior to the release of the STLs and the beginnings to an emphasis on engineering in technology education, Berrett (1999) strove to determine to what degree a conversion to teaching technological literacy had or had not taken root among technology education/industrial education teachers in Utah.

Berrett found that Utah's technology education teachers were in the "early stages of a change effort". Their predominant concerns were in Stage 2 (Personal) and Stage 3 (Management). Berrett also noted that the data indicated teachers "wanted to learn more about the innovation", and that some were already "inexperienced users" with "high concerns in coordination, logistics, and time that is consumed by the user in relation to the innovation."

Of all the studies cited in this investigation, Berrett (1999) is the most easily compared to the current study. Although asking about a different phase of technology and engineering's evolution, both make use of essentially the same instrument. Both studies show a massing at the early Stages of Concern. While he did have scattered responses in the later stages, he makes no mention of a smaller grouping of respondents at Stage 5 (Collaboration). In the absence of any recognizable campaign to shift the curve to the right, this difference suggests that a small group of teachers in the current study have found their own way to accepting the emphasis on engineering.

Although a significant number (15%) appeared to be resistant to dealing with engineering at all, in his more recent study Berrett (2005) found that a "majority of the technology education teachers who responded to his survey are in favor of embracing engineering education to some degree in the technology education curriculum" and "It appears that a smaller majority favor the idea of including engineering education into the overall goals of technological literacy as opposed to replacing the curriculum or having it co-exist in a parallel track". These later finding are very much in keeping with the findings of high scores for the early Stages of Concern in this study.

5.4 Recommendations

This study makes it possible to better understand the level of acceptance to an emphasis on engineering content among secondary education teachers in the State of Utah, but there are a number of questions that remain. If a campaign is going to be mounted to shift teachers' concerns that are currently centered in the early Stages of Concern about implementing engineering into their curriculum towards the higher Stages of Concern, further research will need to be conducted to determine what other factors are being given a higher priority. Clearly, "other factors" are dominating the results of this study as shown by the quantity and intensity of Stage 0 scores. The factors identified by Bussey, et al. (2000) such as inadequate budget, facilities, and resources deserve further investigation. Once their impact (and others) is better understood, more effective in-service training can be presented to address those concerns.

Teacher salaries, class sizes, and the number of different courses taught by the same teacher may all have an impact on the ability to deliver engineering content. Teachers who are restricted by the need to take on a second job, increasingly larger class sizes, or a greater variety of “preps” may be less able to prioritize an emphasis on engineering in their courses. Studies analyzing the impact of each of these factors on the presentation of engineering curriculum have not been found and are recommended for further study.

It is encouraging to note that the teachers in this study are not concerned about the affect an emphasis on engineering would have on students. This can be interpreted as an acceptance that engineering is a positive move forward, but that they are either unable or unknowing about how to deliver a program that emphasizes engineering. It seems prudent to leverage their willingness to learn with the apparent availability of teachers who are interested in collaboration. Many of the districts in Utah are searching for ways to better collaborate. This is a particularly challenging goal for technology and engineering teachers, as they are often “singletons” in their school. In order to be effective, collaboration would need to occur on a district level, in many cases a regional level. Without a coordinating effort from the Utah State Office of Education, such collaboration is unlikely to occur. Research needs to be conducted on the nature of this collaboration, what it looks like and when it is and isn’t effective.

Even with the support of the technology and engineering teachers, a study outlining parent and student perceptions would be of value. Recent legislative changes in Utah have increased the number of math, science, and language credits that are required for high school graduation. It is not known how enrollment in Career and Technology Education (CTE) courses will be affected. Some argue that with less room in their schedule for electives, students will take less CTE courses. Others are pushing for CTE courses to receive math or science credit.

5.5 Summary Statement

An emphasis on engineering has been made within the field of technology education for over a decade, yet it is undetermined to what extent Utah teachers have accepted the change. The purpose of this study was to collect information documenting Utah technology education teachers' acceptance of an emphasis on engineering content in their courses. The Stages of Concern Questionnaire (SoCQ) was used to determine the concerns and level of acceptance of change. It was found that a majority of technology and education teachers are more concerned about other unidentified tasks, activities or initiatives than they are about the addition of engineering content to their classes. To a lesser extent, they were also shown to be concerned with being able to organize, manage, and schedule the change effectively. They were found to be least concerned about the relevance of engineering to students and evaluating student outcomes including performance and competencies. Utah teachers were polarized with respect to collaborating and coordinating with others with regards to engineering.

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APPENDICES

Appendix A. Invitation Letters

March 25th, 2009 Invitation

${m://FirstName},

During the past decade, an emphasis on engineering has been promoted nationally as an evolution in technology education, however; it is undetermined to what extent CTE teachers in Utah have accepted this change. It is important that our profession comes to terms with changes that affect our student enrollment, funding, class schedules, community support, teacher preparation and school programs. This study will help determine how CTE teachers perceive an emphasis on engineering in technology education by measuring their concerns.

Please take a few minutes to contribute to the future of our field by filling out the Stages of Concern Questionnaire (SoCQ) available through the link below. It shouldn't take any more than 10 minutes to complete. The questionnaire includes an instruction page that will provide you with specific directions and a few demographic questions that will help us interpret the data.

Thank you for your participation in this study. Your assistance is greatly appreciated.

Follow this link to the survey:
${l://SurveyLink?d=Take the Survey}

Or copy and paste the url below into your internet browser:
${l://SurveyURL}

Follow this link to opt out of future emails:
${l://OptOutLink}

March 30th, 2009 Invitation

${m://FirstName},

I know your time is limited, but I need your help.

I teach at Bingham High School and am a graduate student at Brigham Young University. I am conducting this survey in order to develop the necessary data to complete my thesis. Technology and engineering education teachers in the State of Utah are a relatively small group. That being the case, every response matters. Your participation is needed in order for this study to be statistically meaningful. It should not take you more than 10 minutes to complete the survey.

You can see why it is important to me, but it may also be important to you. We all have an interest in the future of our field. This is an opportunity for you to offer your views.

I'd like to have the data collected by the end of the week. Please take a moment and complete the survey.

Follow this link to the survey:
${l://SurveyLink?d=Take the Survey}

Or copy and paste the url below into your internet browser:
${l://SurveyURL}

April 6th, 2009 Invitation

${m://FirstName}

I don't mean to be a nag, but your input is really needed. If you would be kind enough to spend about ten minutes responding to this survey, I'd really appreciate it. Every response is important.

As a fellow educator, I understand how little time you have to spare. However, as a technology and engineering education teacher, this survey and the thesis that will result from it should be important to you. In an era when education is sure to see significant budget cuts, it is increasingly important for us to deliver relevant content to our students. The information generated from this survey may help to both clarify our ability to meet that objective and communicate it to others.

Please take a few minutes to complete the survey through the link provided below.

Follow this link to the survey:
${l://SurveyLink?d=Take the Survey}

Or copy and paste the url below into your internet browser:
${l://SurveyURL}

Appendix B. SoCQ Introduction Page

Consent to be a Research Subject

Introduction

This research study is being conducted by Doug Livingston under the direction of Dr. Steven L. Shumway of Brigham Young University to determine how well the relatively recent addition of engineering to technology education is being accepted by teachers in Utah. You were selected to participate because you are currently teaching a technology and engineering course. Authorization to administer this survey has been obtained from your school district and is being conducted with the cooperation of your CTE Director.

Procedures

You will be asked to complete an online questionnaire. The questionnaire consists of 35 questions and will take less than 10 minutes to complete. The questions will ask about your own personal views regarding an increased emphasis on engineering.

The purpose of this questionnaire is to determine what you are thinking about regarding your responsibilities as a change facilitator for the inclusion of engineering with technology education. It is not necessarily assumed that you have change facilitator responsibilities. This questionnaire is designed for persons who do not serve as change facilitators as well as for those who have major responsibility for facilitating change. Because the questionnaire attempts to include statements that are appropriate for widely diverse roles, there will be items that appear to be of little relevance or irrelevant to you at this time. For the irrelevant items, please mark circle "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

This statement is very true of me now.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

This statement is not at all true of me at this time.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

This statement seems irrelevant to me.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Please respond to the items in terms of your present concerns, or how you feel about your involvement or potential involvement in technology and engineering education. We do not hold any one definition of this innovation, so please think of it in terms of your own perception of what it involves.

Use the last question to express any additional concerns you have about technology and engineering education or this questionnaire.

Confidentiality

For follow up purposes and in order to identify the data being gathered, a number has been assigned to your questionnaire. We will maintain your anonymity by using this number rather than your name in our analysis.

All information provided will remain confidential and will only be reported as group data with no identifying information. All data will be kept in a locked storage cabinet and only those directly involved with the research will have access to them. After the research is completed, all responses will be destroyed.

Thank you for taking a few minutes to complete this questionnaire.

Appendix C. SoCQ Survey Items

Q01. I am concerned about students' attitudes toward an emphasis on engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q02. I now know of some other approaches that might work better than an emphasis on engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q03. I am more concerned about another innovation in technology education than I am about emphasizing engineering content.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q04. I am concerned about not having enough time to organize myself each day.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q05. I would like to help other faculty in their use of engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q06. I have a very limited knowledge about engineering in technology education courses.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q07. I would like to know the effect that an emphasis on engineering would have on my professional status.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q08. I am concerned about conflict between my interests and my responsibilities.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q09. I am concerned about revising my use of engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q010. I would like to develop working relationships with both our faculty and outside faculty using engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q011. I am concerned about how an emphasis on engineering affects technology education students.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q012. I am not concerned about an emphasis on engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q013. I would like to know who will make the decisions in the new system.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q014. I would like to discuss the possibility of using engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q015. I would like to know what resources are available if we decide to emphasize engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q016. I am concerned about my ability to manage all that an emphasis on engineering requires.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q017. I would like to know how my teaching or administration is supposed to change.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q018. I would like to familiarize other departments or persons with the progress of engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q019. I am concerned about evaluating my impact on students.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q020. I would like to revise the approach to emphasizing engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q021. I am preoccupied with things other than an emphasis on engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q022. I would like to modify our use of engineering in technology education based on the experience of our students.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q023. I spend little time thinking about engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q024. I would like to excite my students about their part in engineering as it relates to technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q025. I am concerned about the time spent in working with nonacademic problems related to emphasizing engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q026. I would like to know what emphasizing engineering content in technology education will require in the immediate future.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q027. I would like to coordinate my efforts with others to maximize the effect of emphasizing engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q028. I would like to have more information on time and energy commitments required by emphasizing engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q029. I would like to know what other faculty are doing in this area.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q030. Currently, other priorities prevent me from focusing my attention on engineering in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q031. I would like to determine how to supplement, enhance or replace engineering content in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q032. I would like feedback from students to change the program.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q033. I would like to know how much my role will change when I am using engineering in technology education courses.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q034. Coordination of tasks and people is taking too much of my time.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Q035. I would like to know how an emphasis in engineering is better than what we have now in technology education.

Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	
0	1	2	3	4	5	6	7

Appendix D. Additional Questions

Q0. How would you define "engineering"?

Q91. In your opinion, a technology and engineering course taught to secondary education students must include: *check all that apply*

- ☐ problem solving
- ☐ the creation of technical drawings
- ☐ prototyping
- ☐ real world constraints
- ☐ physics
- ☐ higher level mathematics
- ☐ predictive analysis
- ☐ optimization
- ☐ other
- ☐ none of the above

Q47. Do you have any comments that you would like to offer about technology and engineering education?

Q37. Your gender is:

- ☐ Male
- ☐ Female

Q38. Your age is:

- ☐ 20-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-50
- ☐ 60+

Q39. The highest degree you have earned is:

- ☐ None
- ☐ Associate
- ☐ Bachelor
- ☐ Master
- ☐ Doctorate

Q40. You presently teach at a:

- ☐ Middle School
- ☐ Junior High School
- ☐ High School

Q41. **You currently teach students in grades:** *check all that apply*

- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12

Q42. **What percentage of your teaching is spent in:**

- ☐ Technology and Engineering Education
- ☐ Other

Q43. **Please indicate which courses you are currently teaching:** *check all that apply*

- ☐ 210102 Exploring Technology
- ☐ 210104 Foundations of Technology
- ☐ 210105 Physics with Technology
- ☐ 210106 Physics with Technology 2
- ☐ 210107 Industrial and Agricultural Technology
- ☐ 210108 Introduction to Communications Technology
- ☐ 210109 Introduction to Construction Technology
- ☐ 210110 Introduction to Manufacturing Technology
- ☐ 210111 Introduction to Transportation and Energy Technology
- ☐ 210112 Advanced Technology Education
- ☐ 210114 Pre-engineering Technology
- ☐ 210115 Engineering Design
- ☐ 210116 Materials and Processes
- ☐ 210120 Introduction to Engineering Design - PLTW
- ☐ 210121 Digital Electronics - PLTW
- ☐ 210122 Principles of Engineering - PLTW
- ☐ 210123 Computer Integrated Manufacturing - PLTW
- ☐ 210124 Engineering Design and Development - PLTW
- ☐ 210125 Civil Engineering and Architecture - PLTW

Q44. **You have been at your present school for:**

- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-25 years
- ☐ 26+ years

Q45. **Your total experience teaching is:**

- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-25 years
- ☐ 26+ years

Q46. **You attended professional training (i.e., workshops, in-service, conference, or classes) designed to enhance your abilities as a technology and engineering teacher during the years:** *check all that apply*

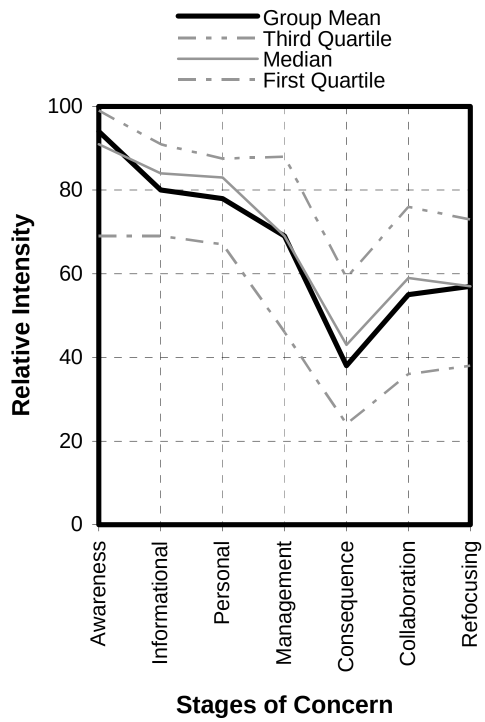
- ☐ 2009
- ☐ 2005-2008
- ☐ 2000-2004
- ☐ 1995-1999
- ☐ 1990-1994

Q48. Would you like a copy of the results of this research sent to you?

- ☐ Yes, If yes, please indicate the e-mail address you would like used
- ☐ No

Appendix E. Individual SoCQ Profiles

Gender	N/A
Age	N/A
Years Teaching	N/A
Highest Degree Earned	N/A
Training during 2009	N/A
Training during 2005-2008	N/A
Training during 2000-2004	N/A
Type of School	N/A
District Classification	N/A
Technology & Engineering FTE%	N/A

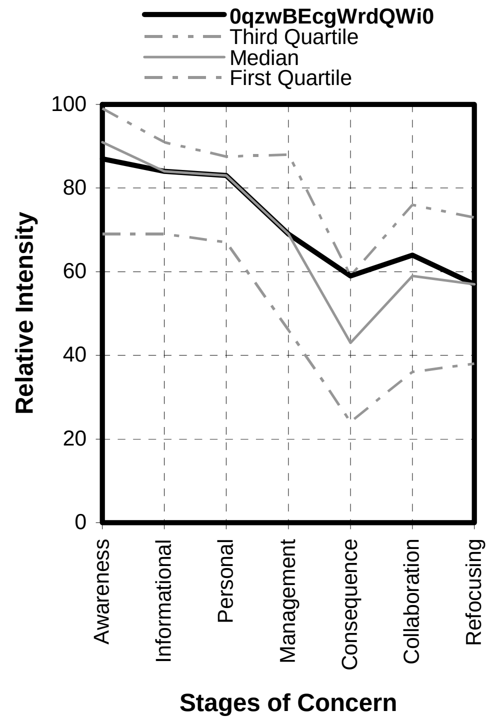


Note: Districts were classified according to their percentage of the state's overall technology & engineering education FTE as shown in Table E-1: District Classification.

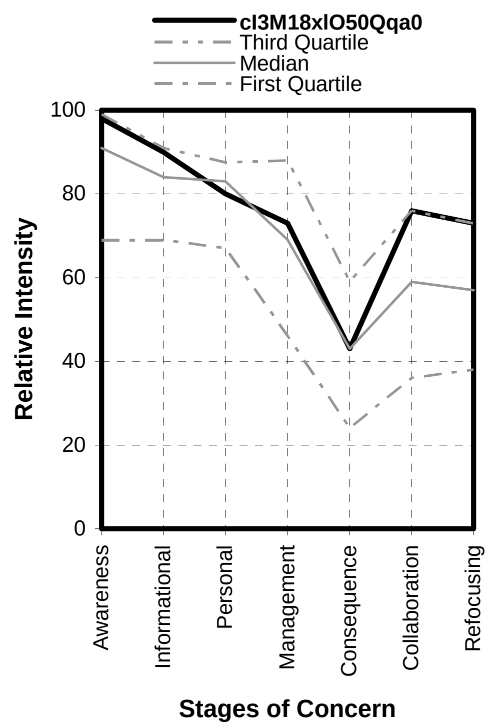
Table E-1: District Classification

Classification	%FTE
A	0.00-0.49%
B	0.50-1.49%
C	1.50-2.99%
D	3.00-7.49%
E	7.50+%

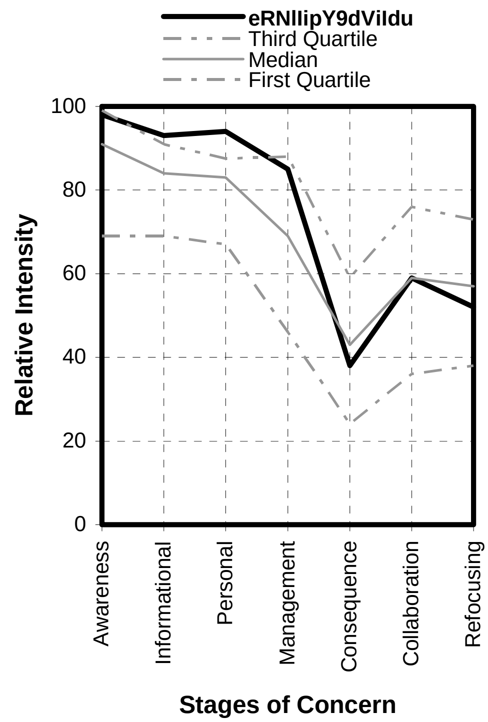
Gender Male
Age 40-49
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 100%



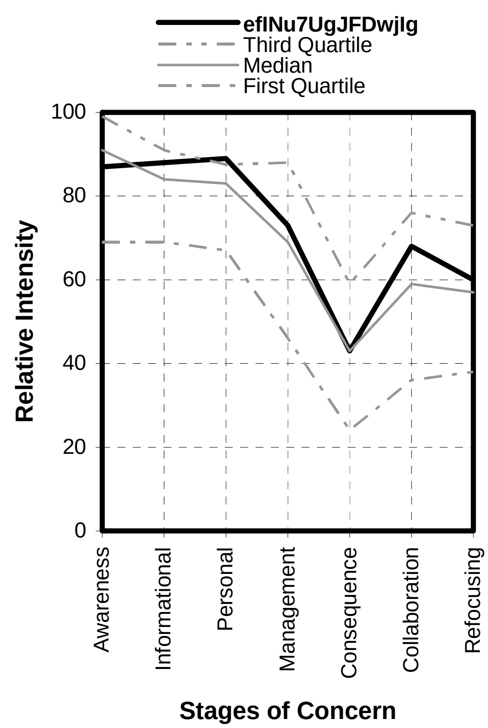
Gender Male
Age 40-49
Years Teaching 11-15
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification E
Technology & Engineering FTE% 23%



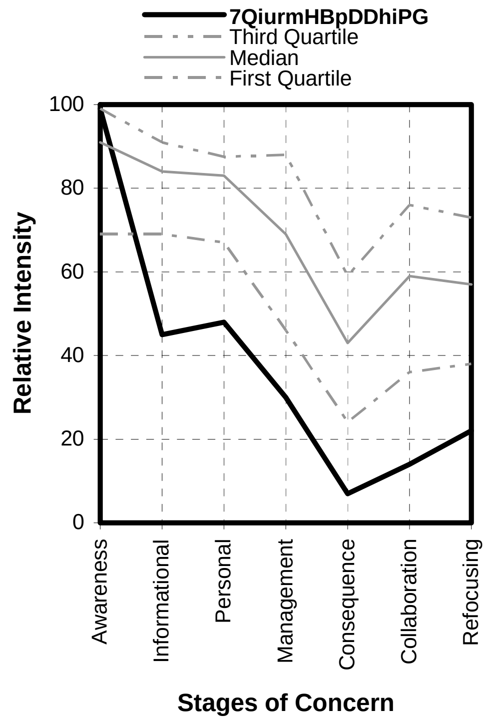
Gender	Male
Age	40-49
Years Teaching	16-25
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	31%



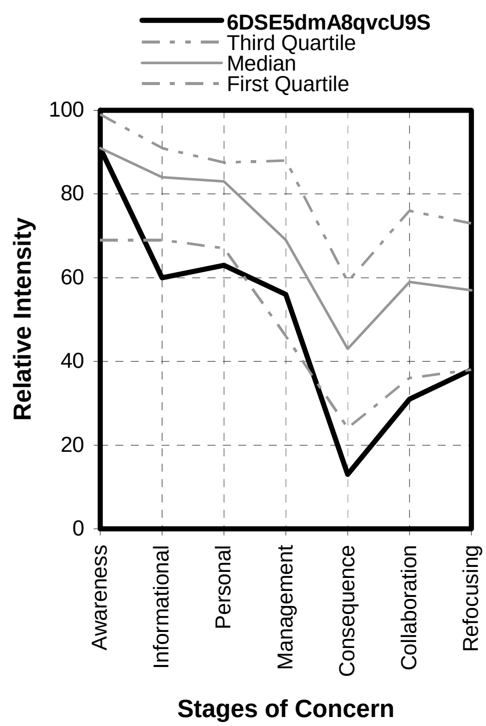
Gender	Male
Age	30-39
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	100%



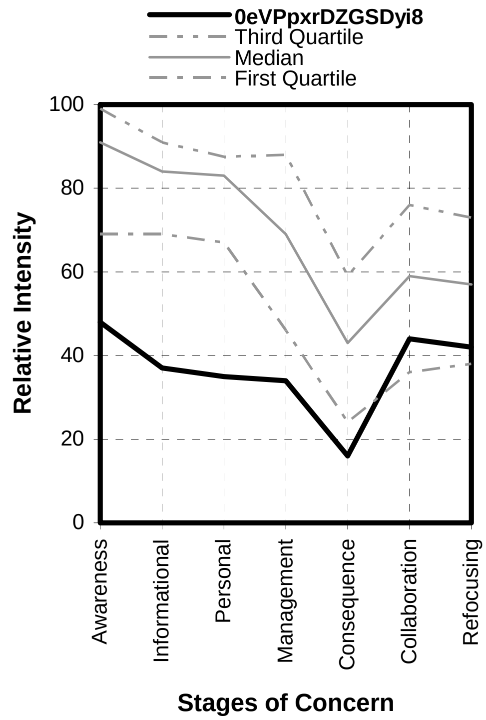
Gender Male
Age 30-39
Years Teaching 6-10
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 72%



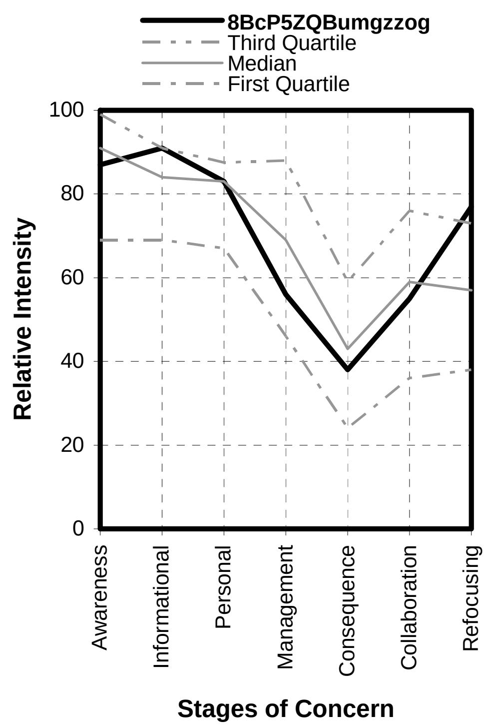
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification B
Technology & Engineering FTE% 40%



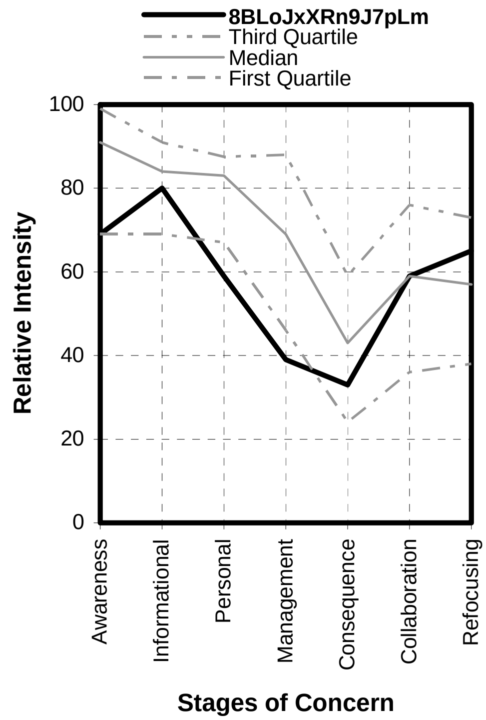
Gender Male
Age 60-older
Years Teaching 6-10
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification E
Technology & Engineering FTE% 100%



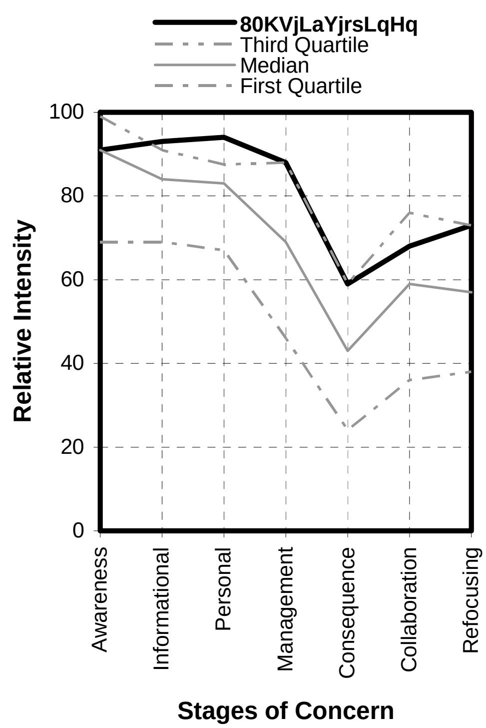
Gender Female
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 100%



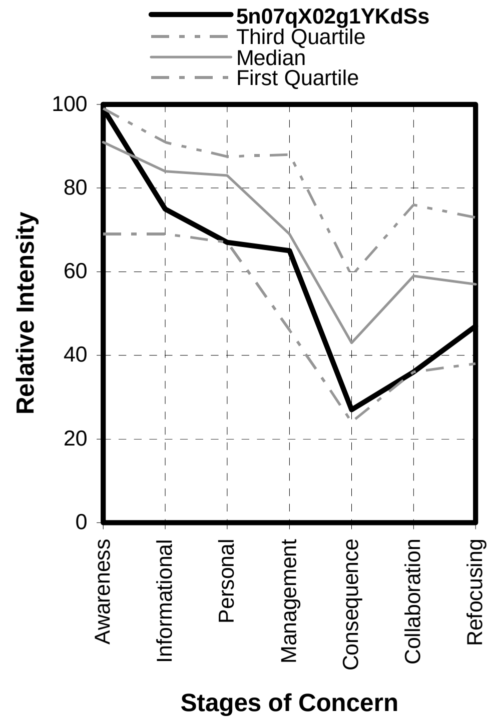
Gender Female
Age 30-39
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 45%



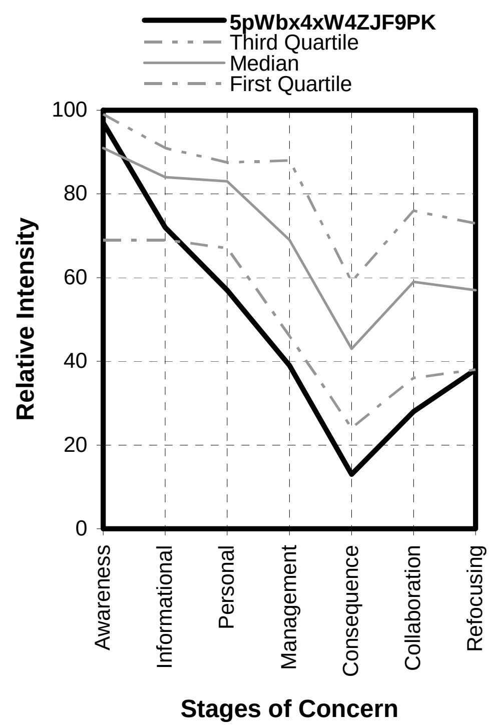
Gender Male
Age 30-39
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 Yes
Type of School Senior High
District Classification B
Technology & Engineering FTE% 100%



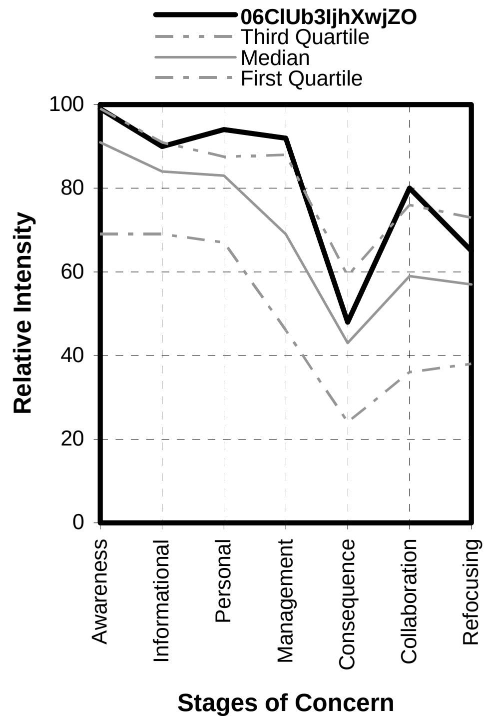
Gender Male
Age 40-49
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 100%



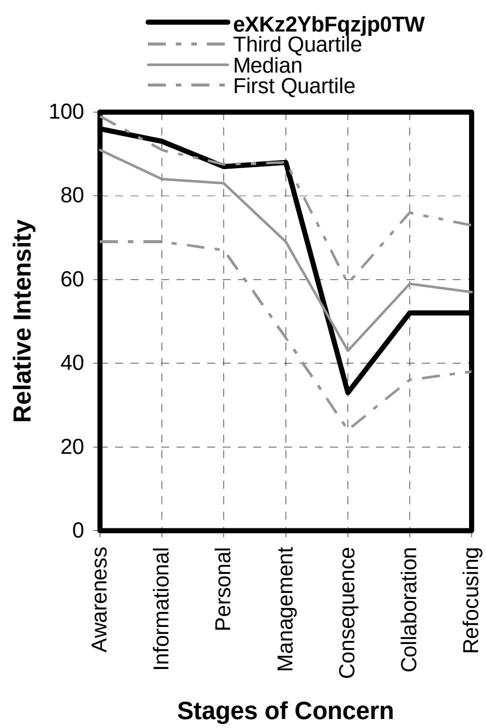
Gender Male
Age 40-49
Years Teaching 11-15
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 33%



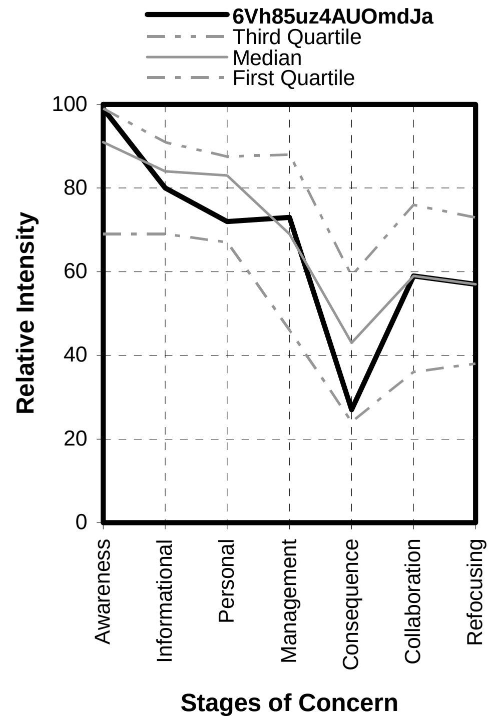
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification E
Technology & Engineering FTE% 77%



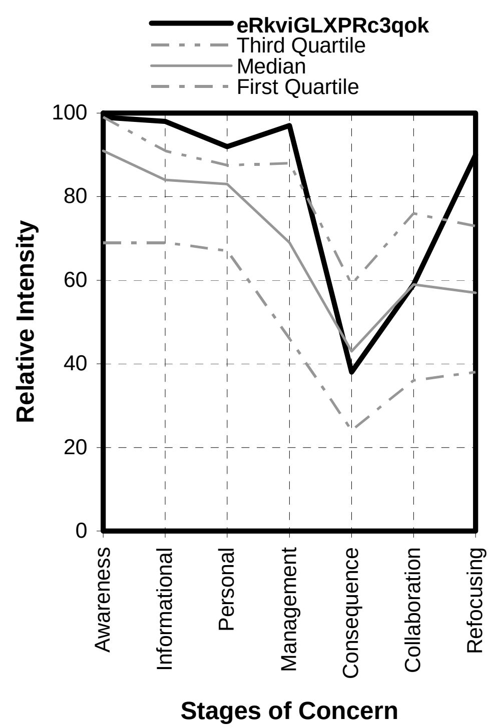
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 61%



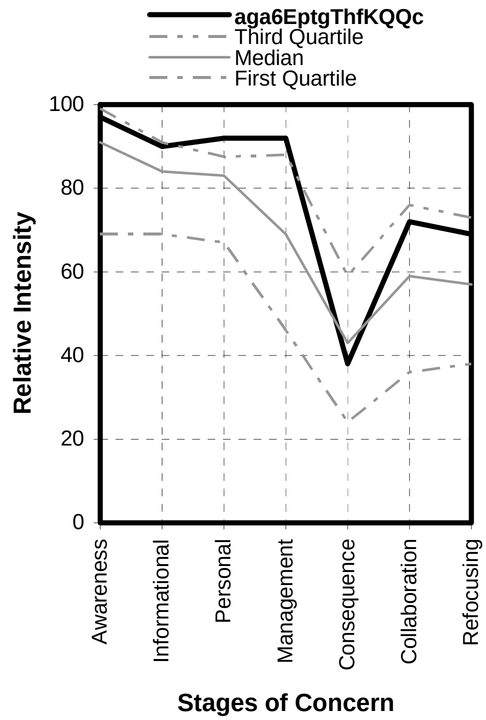
Gender Female
Age 40-49
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 Yes
Type of School Senior High
District Classification A
Technology & Engineering FTE% 7%



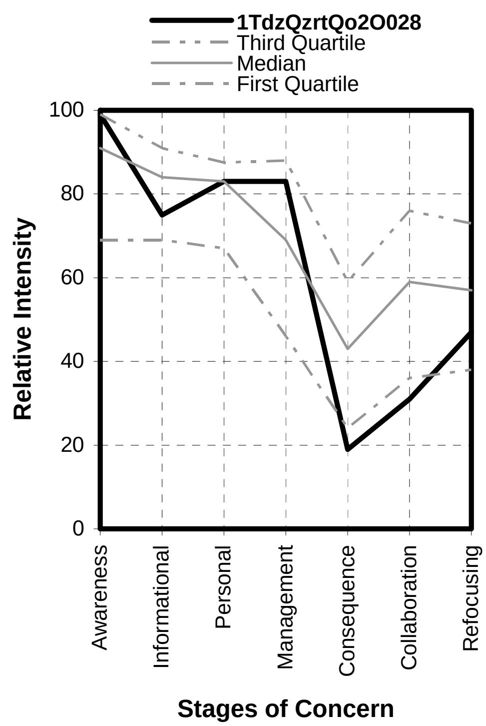
Gender Male
Age 50-59
Years Teaching 26+
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 100%



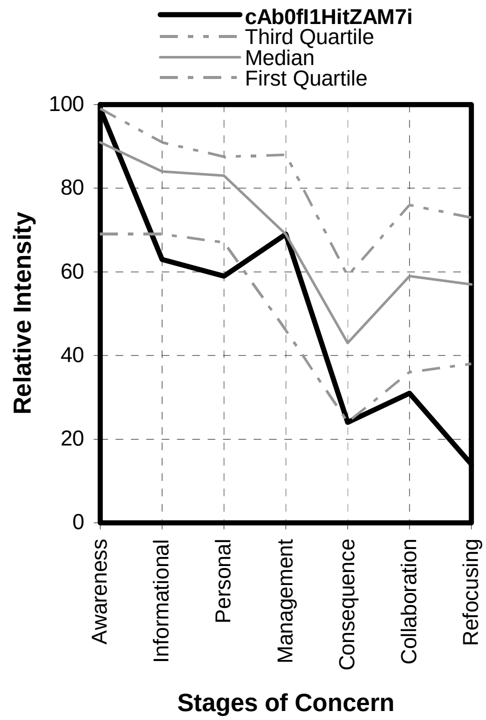
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Senior High
District Classification B
Technology & Engineering FTE% 32%



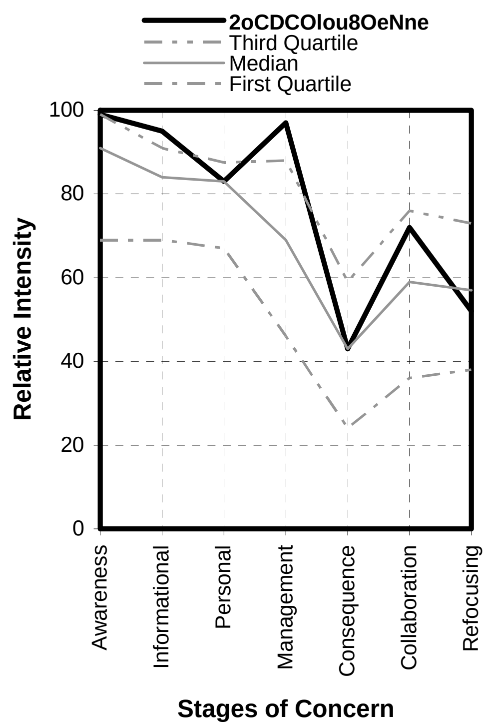
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification D
Technology & Engineering FTE% 43%



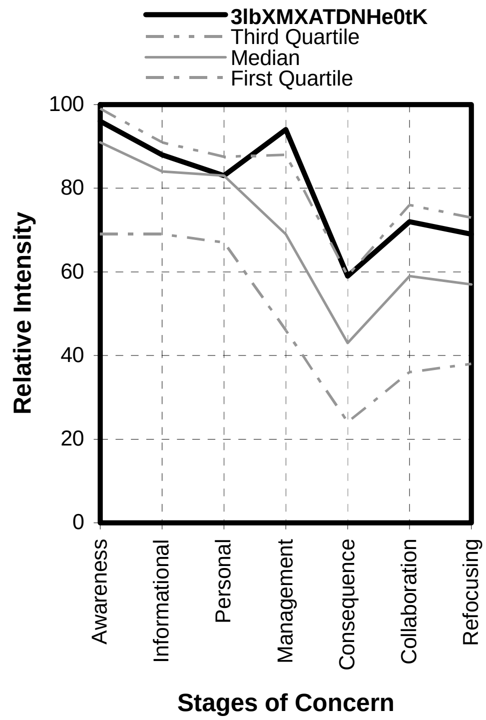
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	No
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	63%



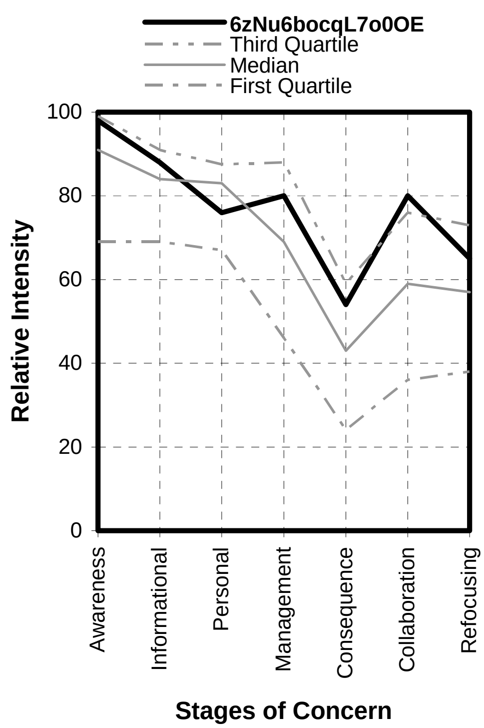
Gender	Male
Age	30-39
Years Teaching	1-5
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	43%



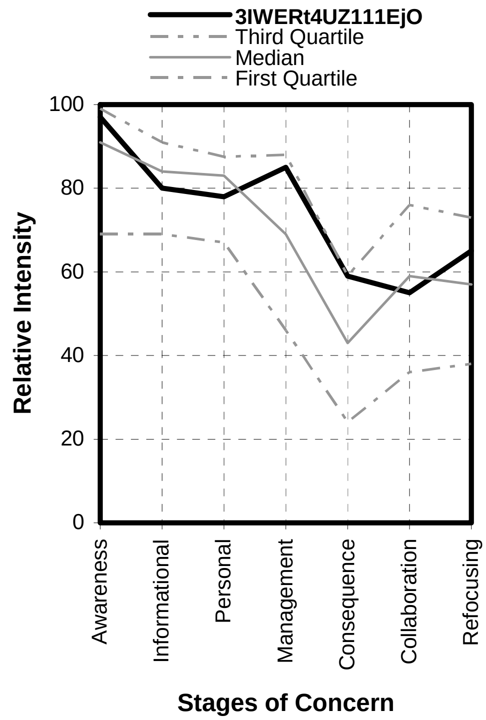
Gender	Male
Age	30-39
Years Teaching	6-10
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	34%



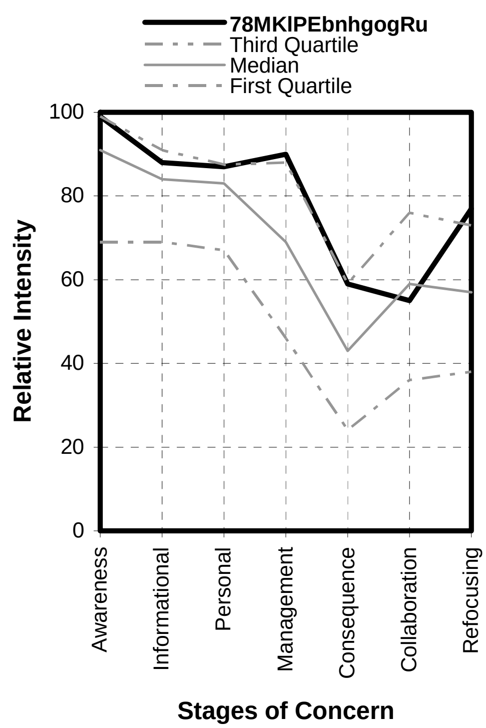
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	92%



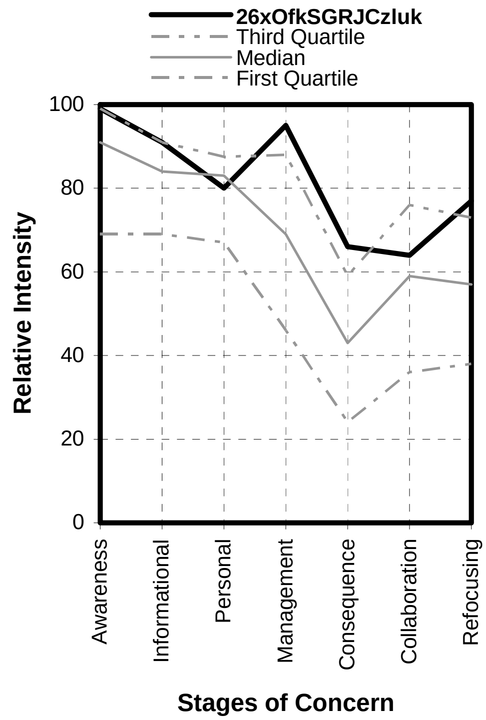
Gender	Female
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	44%



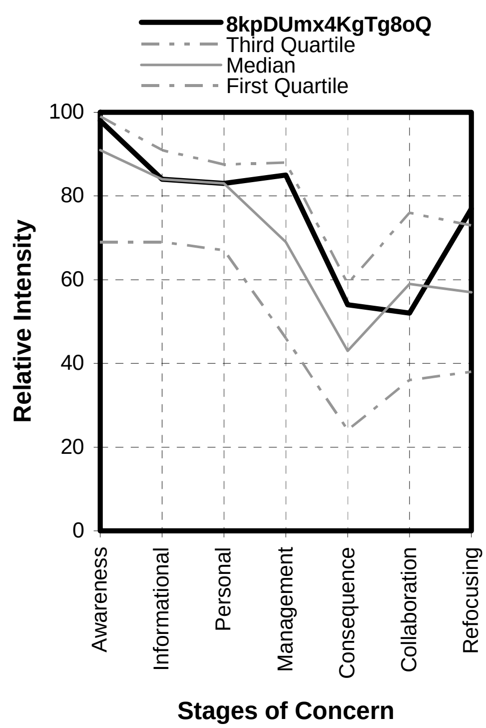
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	No
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	107%



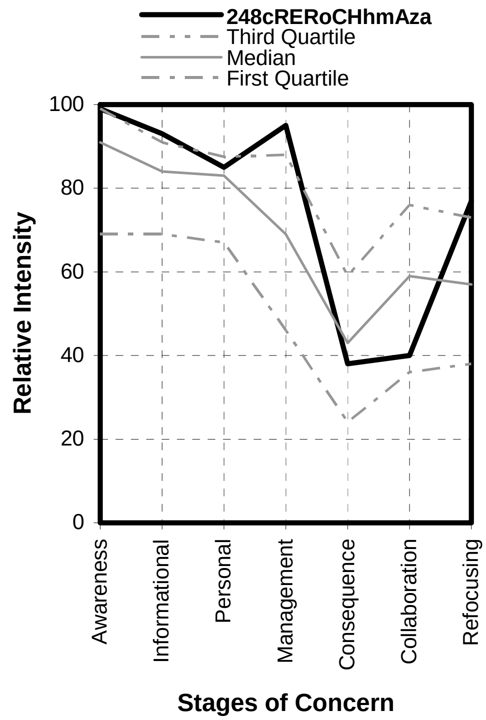
Gender	Male
Age	40-49
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	No
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	B
Technology & Engineering FTE%	100%



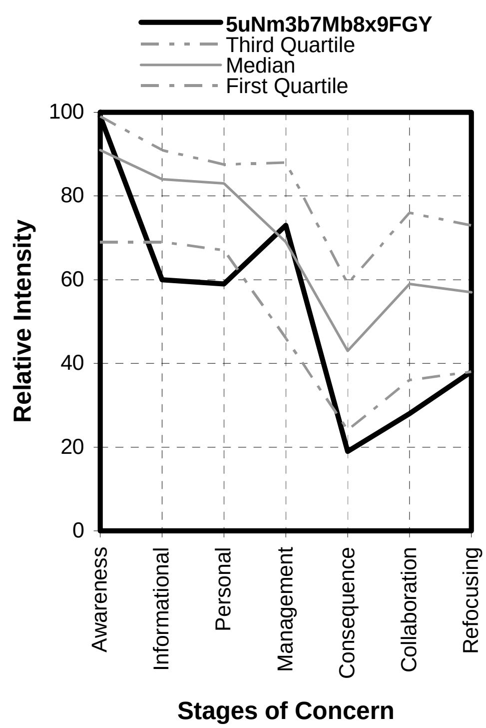
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	73%



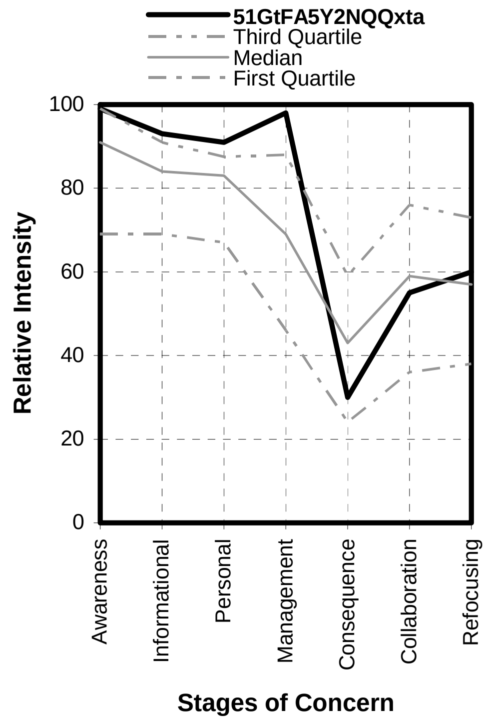
Gender	Male
Age	40-49
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	67%



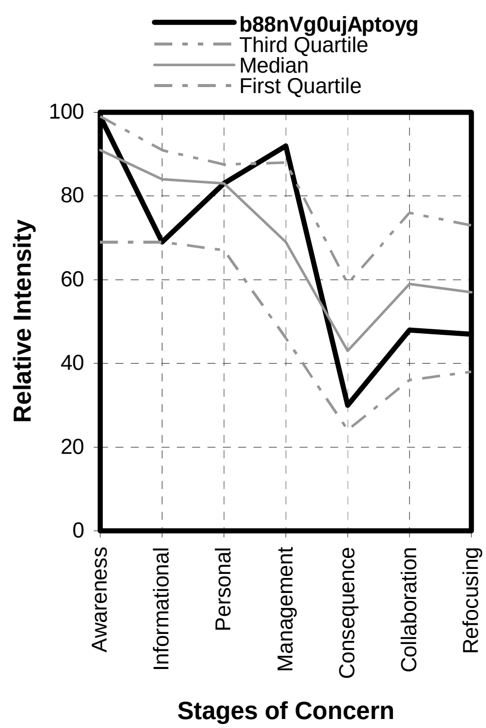
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	50%



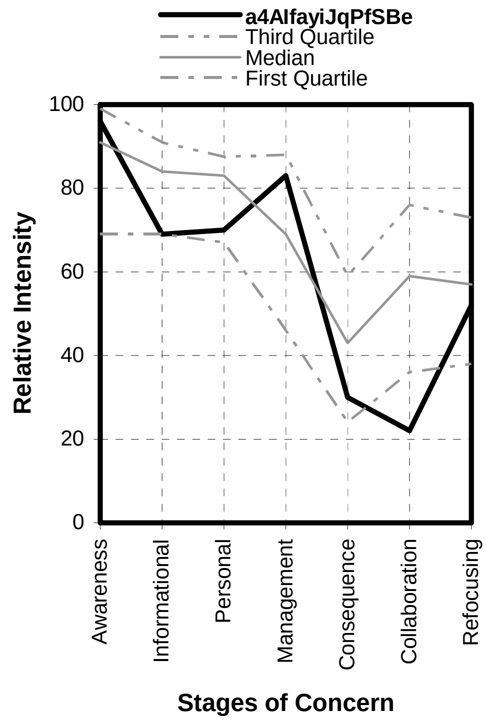
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	100%



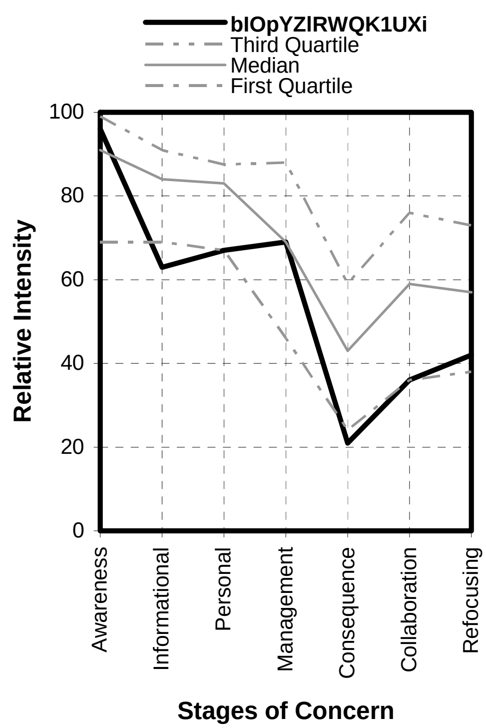
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	9%



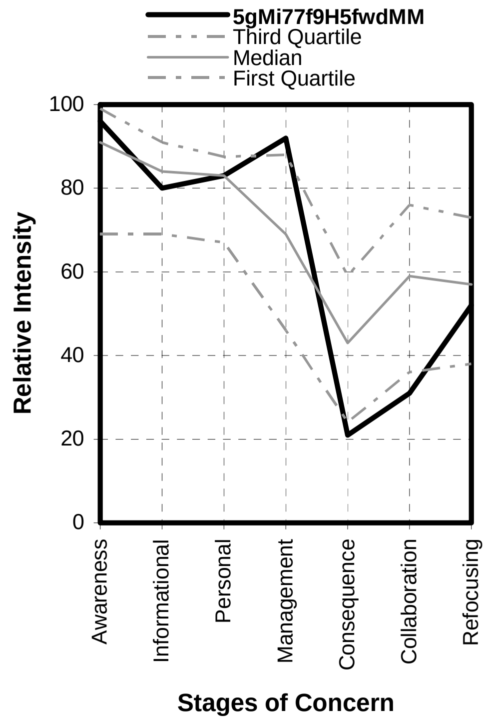
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 16%



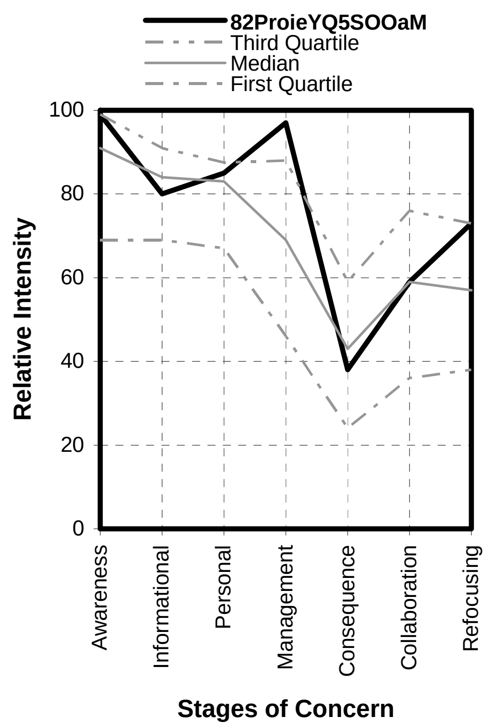
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Senior High
District Classification C
Technology & Engineering FTE% 39%



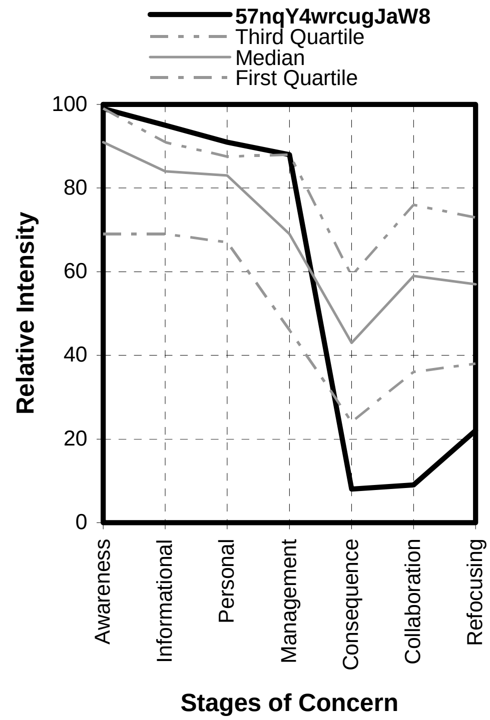
Gender	Male
Age	40-49
Years Teaching	16-25
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	33%



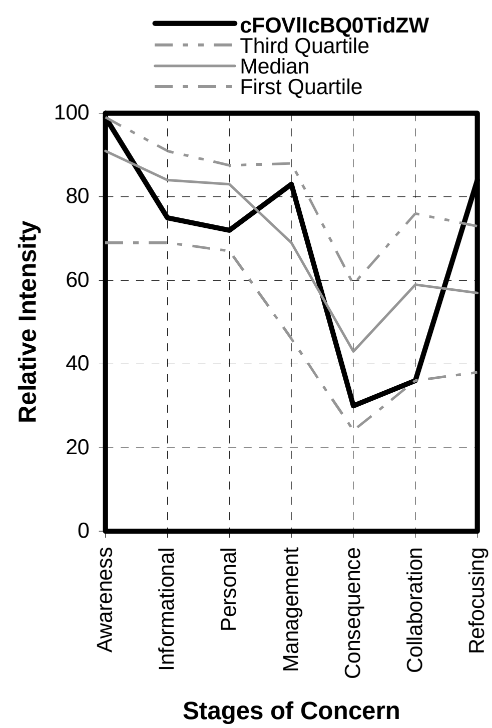
Gender	Male
Age	50-59
Years Teaching	Not Reported
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	No
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	50%



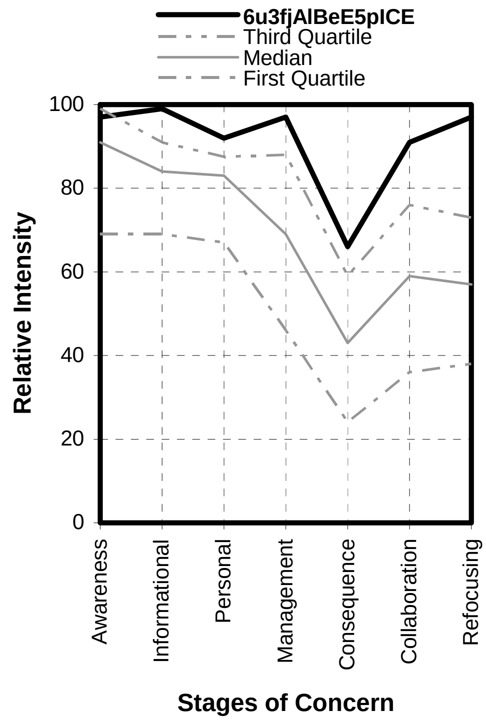
Gender Male
Age 30-39
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Senior High
District Classification A
Technology & Engineering FTE% 25%



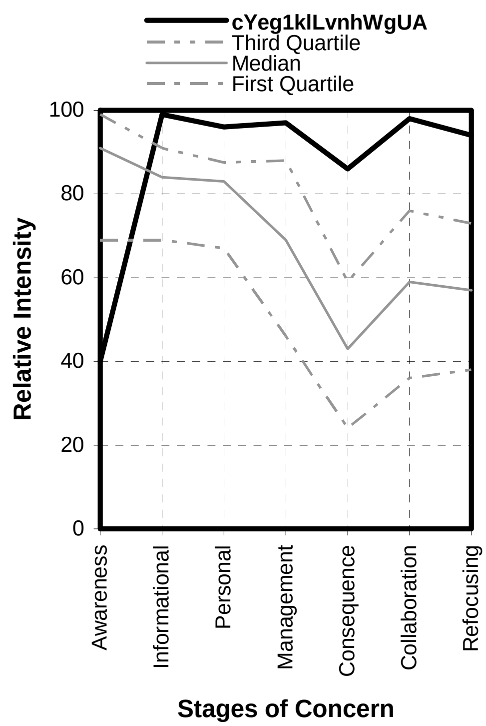
Gender Male
Age 30-39
Years Teaching 11-15
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Senior High
District Classification C
Technology & Engineering FTE% 16%



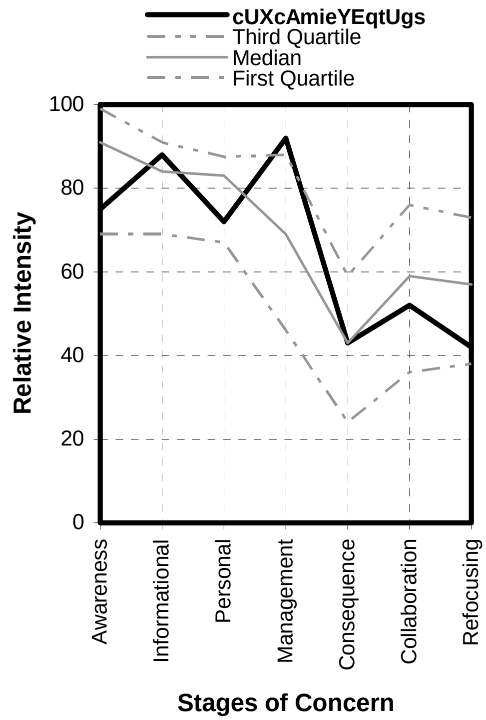
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification E
Technology & Engineering FTE% 95%



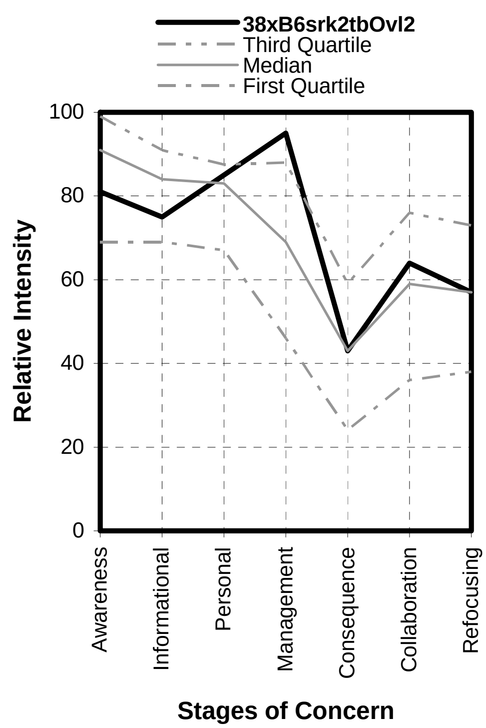
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 80%



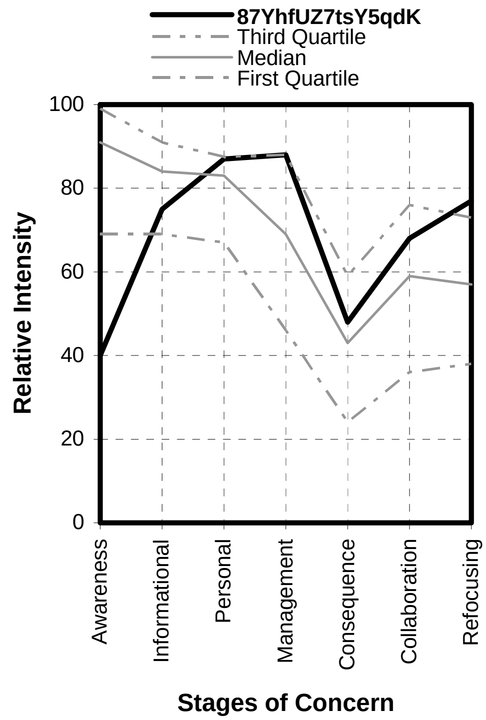
Gender	Male
Age	30-39
Years Teaching	6-10
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	71%



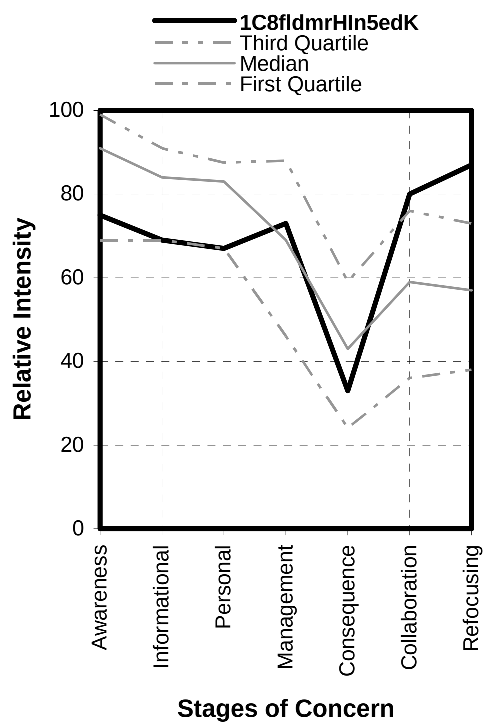
Gender	Male
Age	30-39
Years Teaching	6-10
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	31%



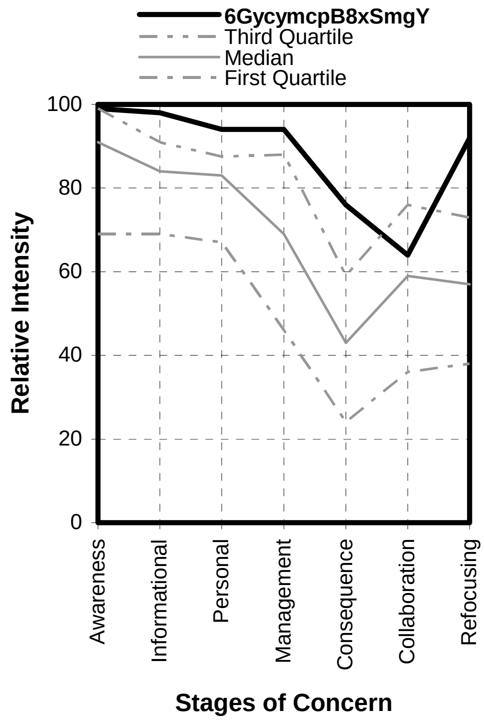
Gender Female
Age 40-49
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Senior High
District Classification B
Technology & Engineering FTE% 67%



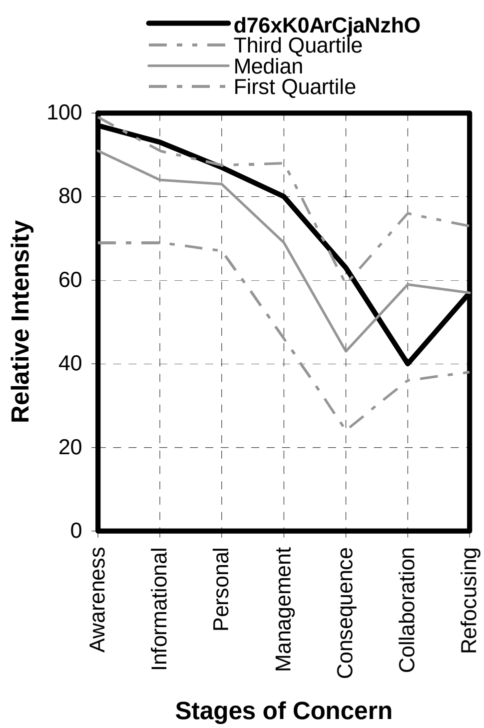
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 50%



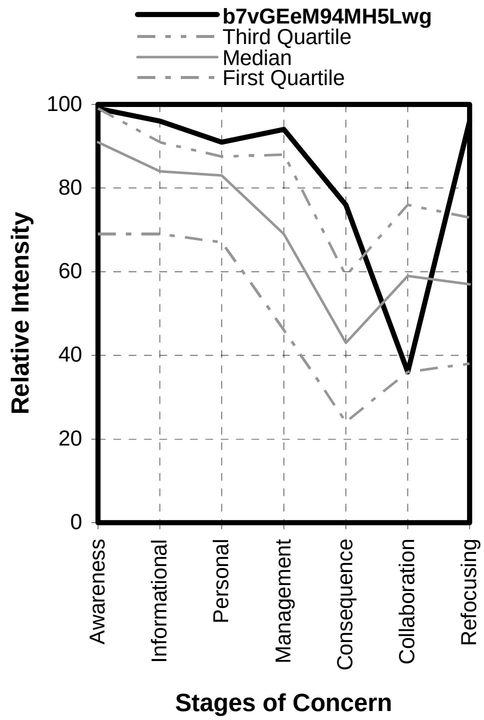
Gender Male
Age 40-49
Years Teaching 11-15
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification C
Technology & Engineering FTE% 39%



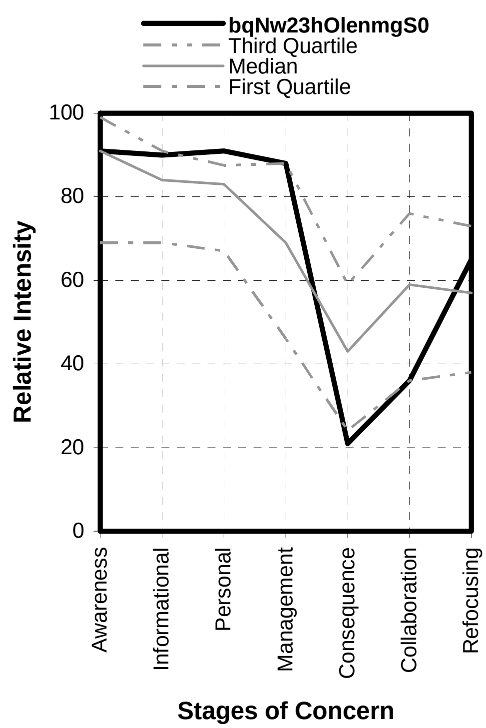
Gender Female
Age 40-49
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 50%



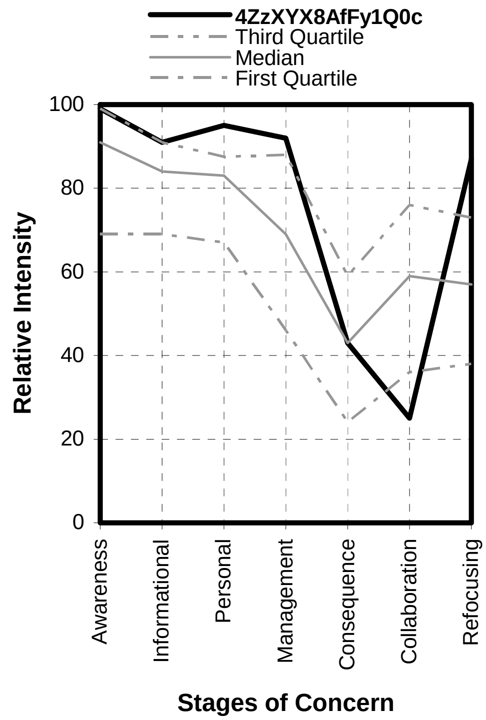
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	36%



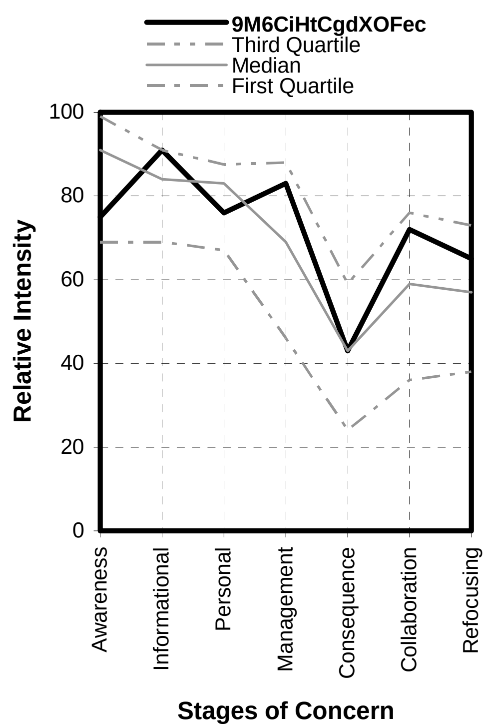
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	17%



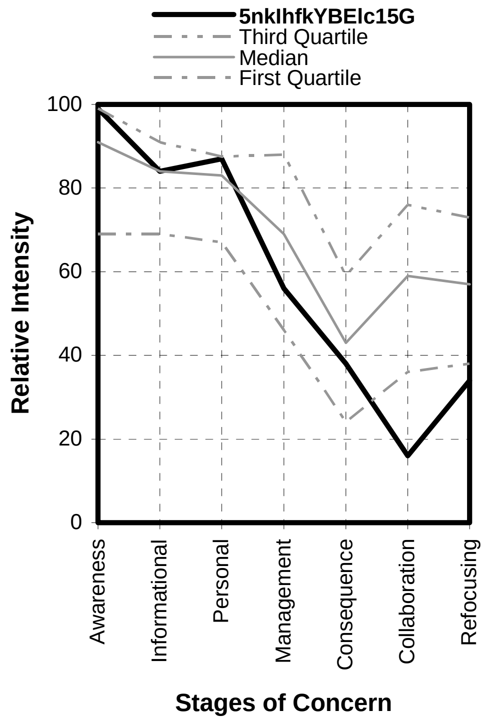
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 34%



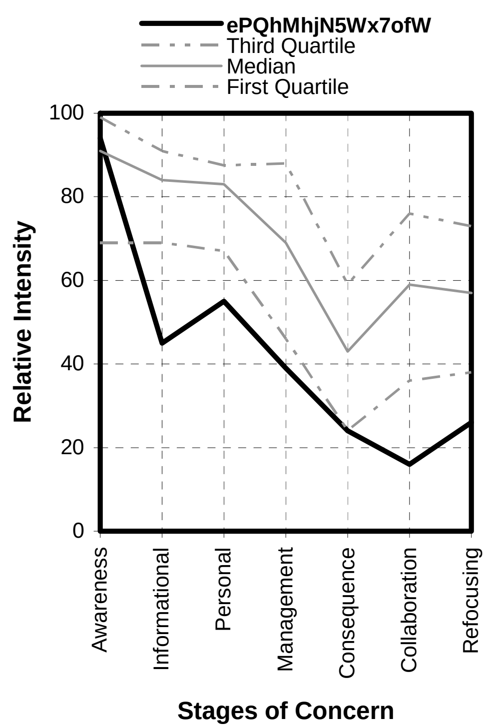
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification C
Technology & Engineering FTE% 100%



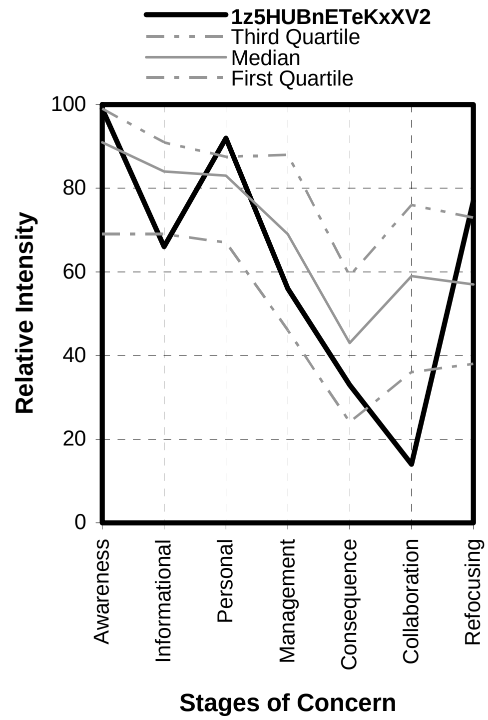
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 20%



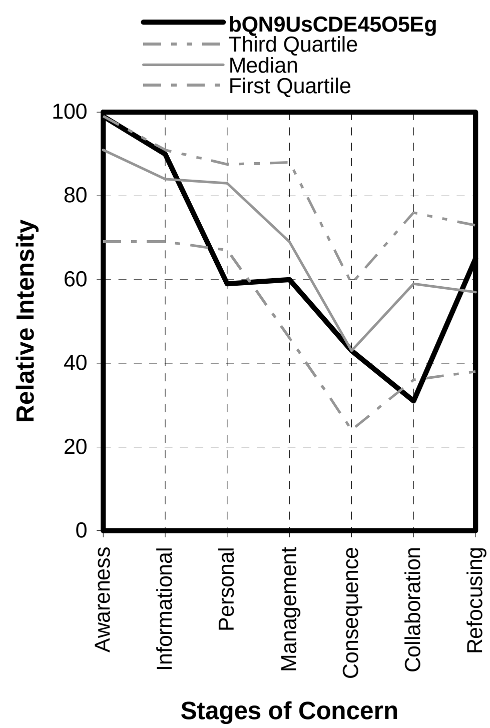
Gender Male
Age 20-29
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 50%



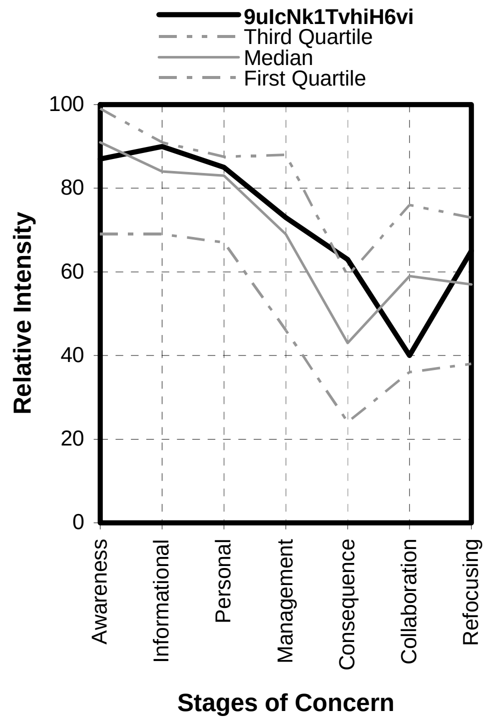
Gender Male
Age 50-59
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification C
Technology & Engineering FTE% 33%



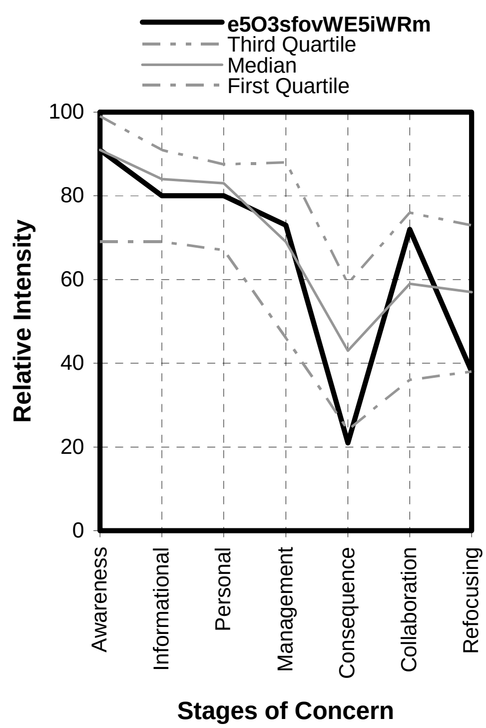
Gender Male
Age 50-59
Years Teaching 11-15
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 8%



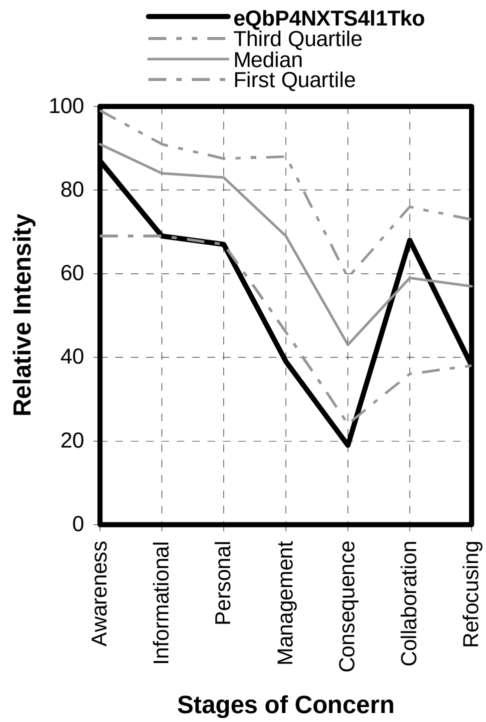
Gender	Male
Age	50-59
Years Teaching	6-10
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	78%



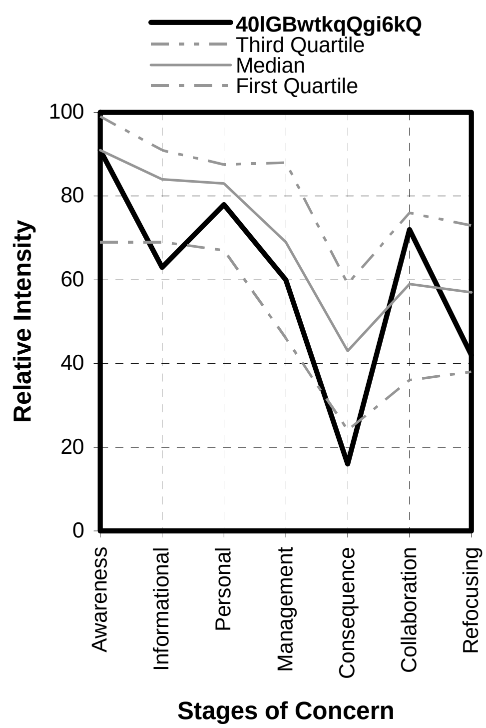
Gender	Female
Age	40-49
Years Teaching	16-25
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	17%



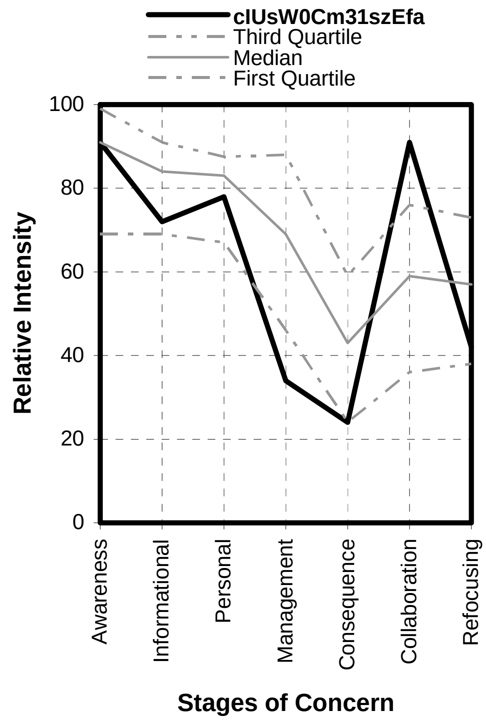
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	100%



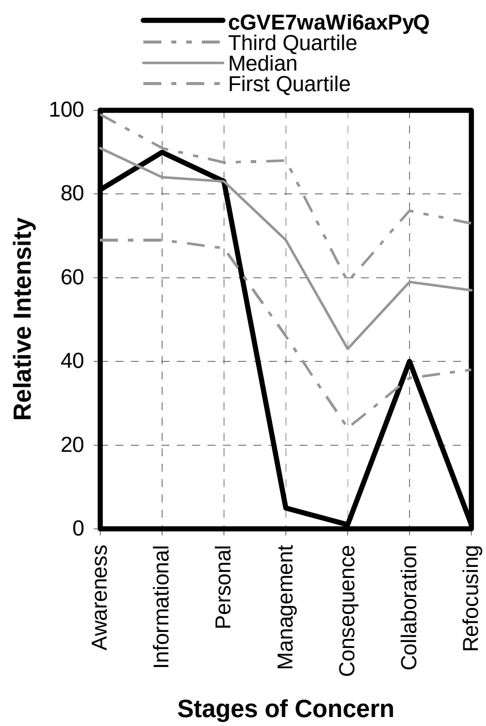
Gender	Male
Age	50-59
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	59%



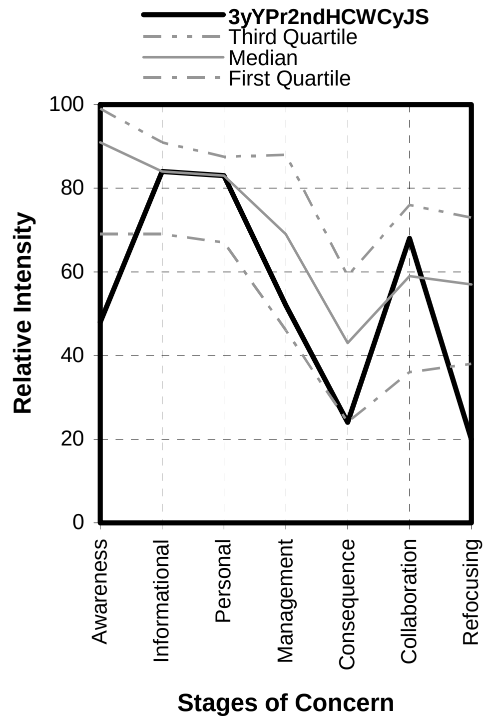
Gender	Male
Age	30-39
Years Teaching	1-5
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	100%



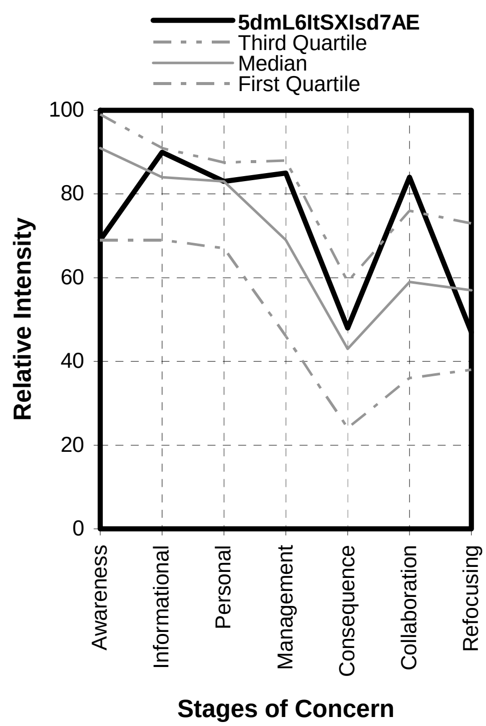
Gender	Male
Age	30-39
Years Teaching	6-10
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	B
Technology & Engineering FTE%	30%



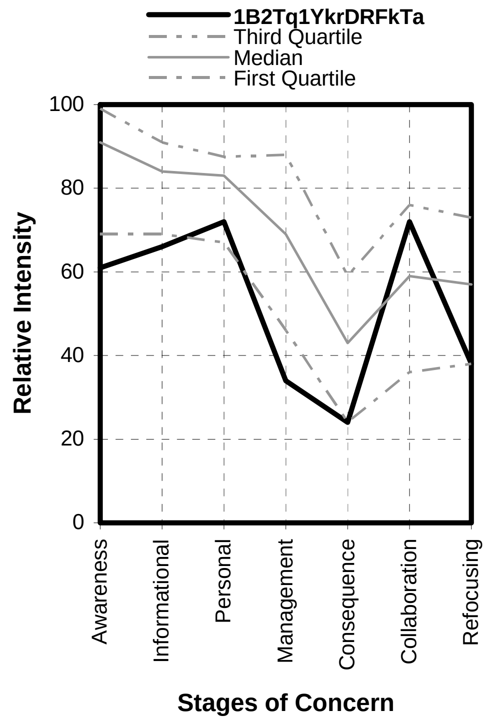
Gender	Male
Age	60-older
Years Teaching	16-25
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	A
Technology & Engineering FTE%	50%



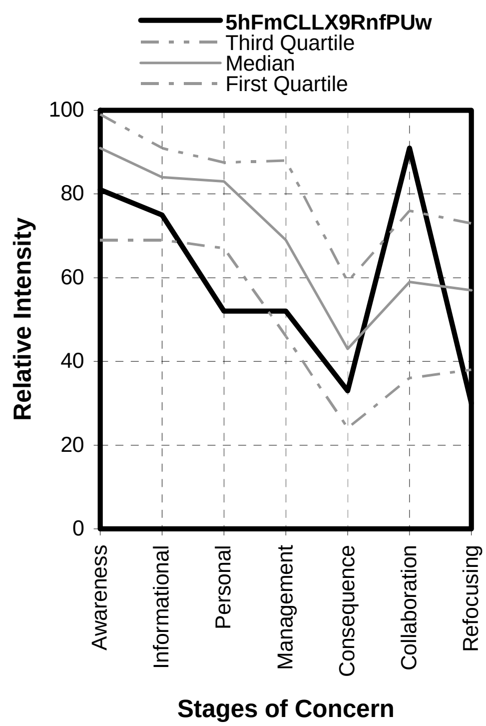
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	48%



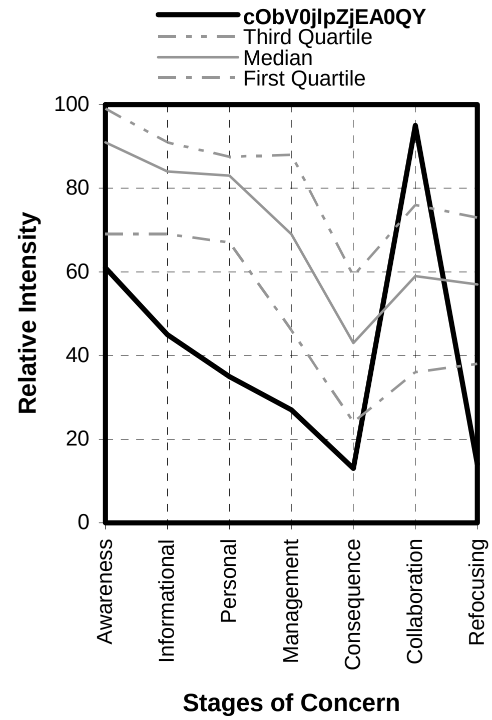
Gender Female
Age 20-29
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 33%



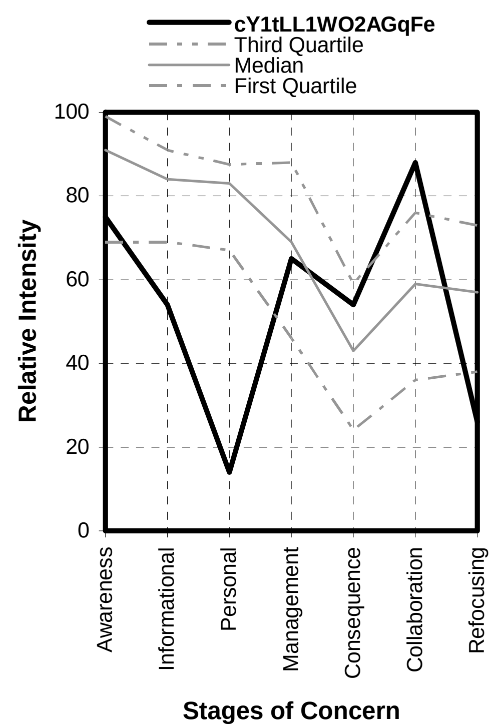
Gender Male
Age 30-39
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Senior High
District Classification C
Technology & Engineering FTE% 22%



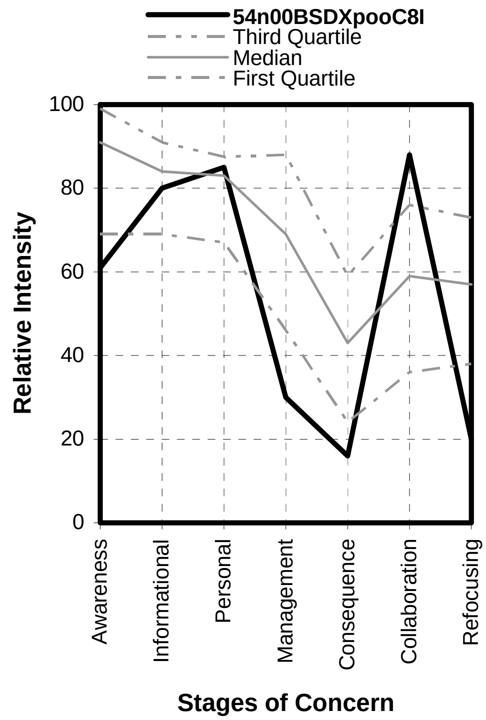
Gender	Male
Age	30-39
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	66%



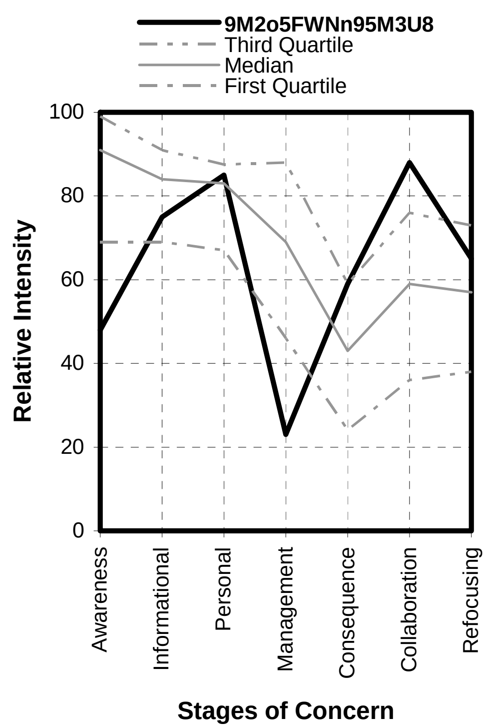
Gender	Male
Age	40-49
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	50%



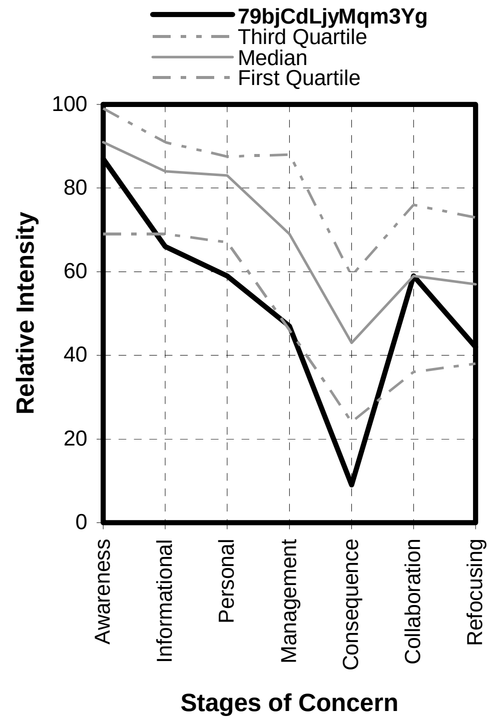
Gender	Male
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	B
Technology & Engineering FTE%	13%



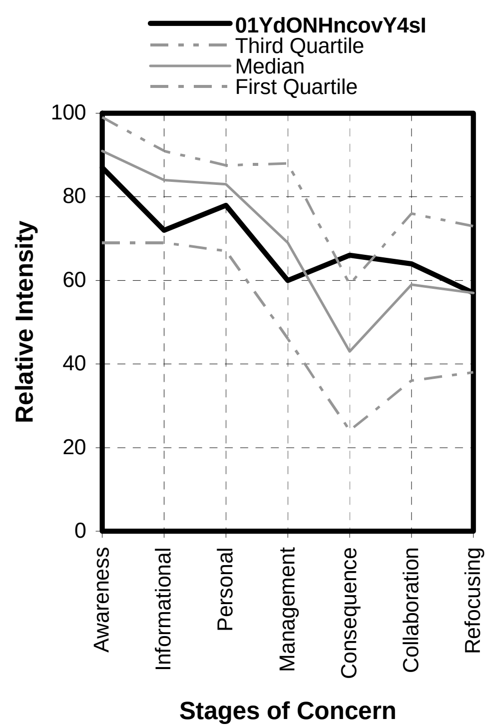
Gender	Female
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	56%



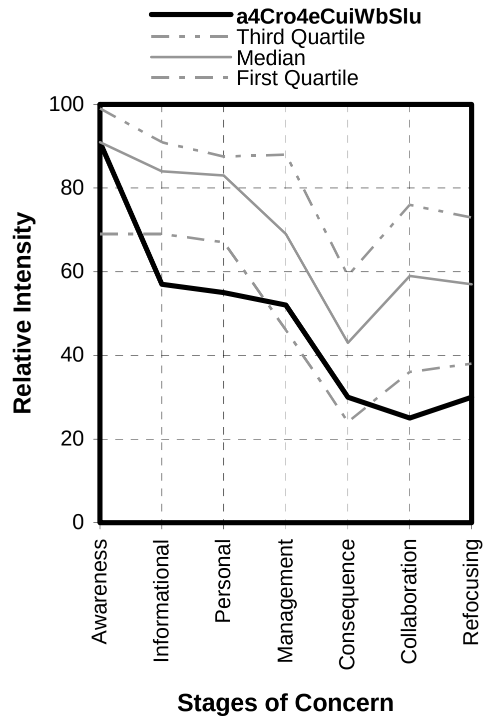
Gender Male
Age 60-older
Years Teaching 26+
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 49%



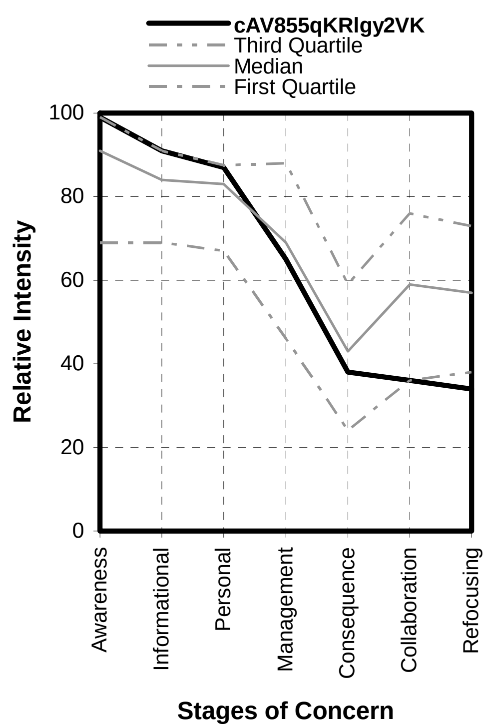
Gender Male
Age 50-59
Years Teaching 6-10
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification D
Technology & Engineering FTE% 28%



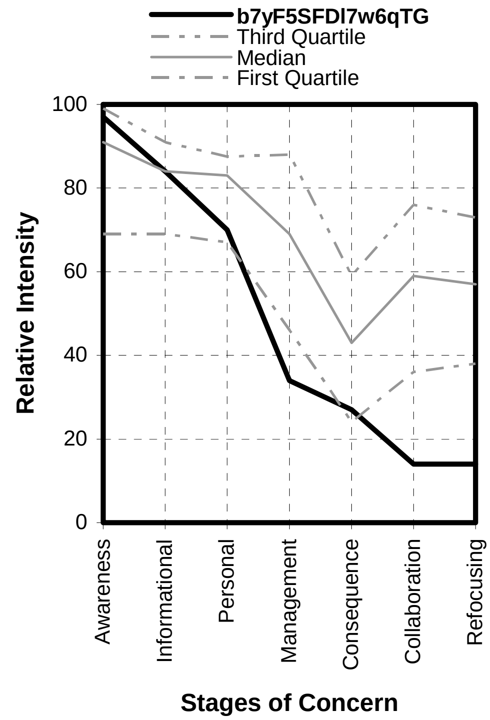
Gender	Female
Age	50-59
Years Teaching	16-25
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	67%



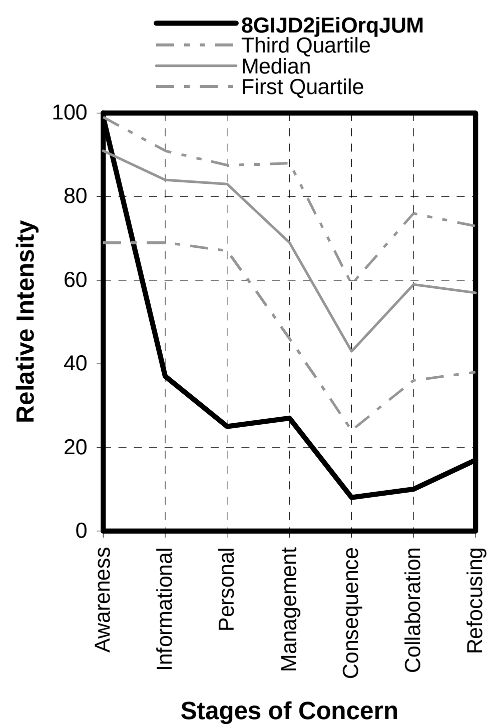
Gender	Male
Age	40-49
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	22%



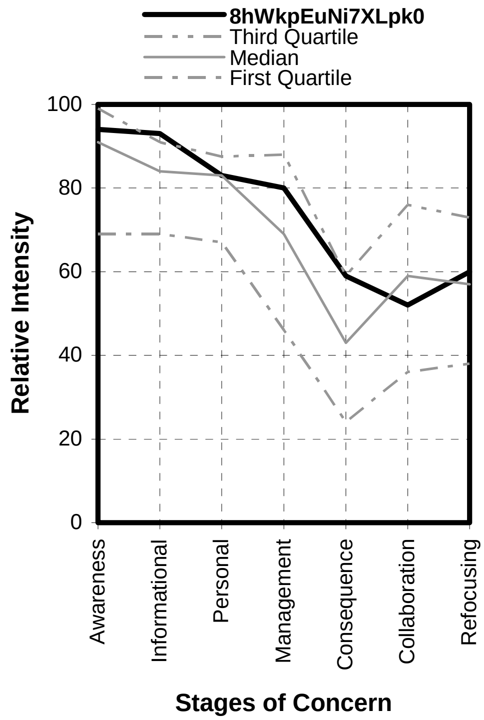
Gender	Male
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	40%



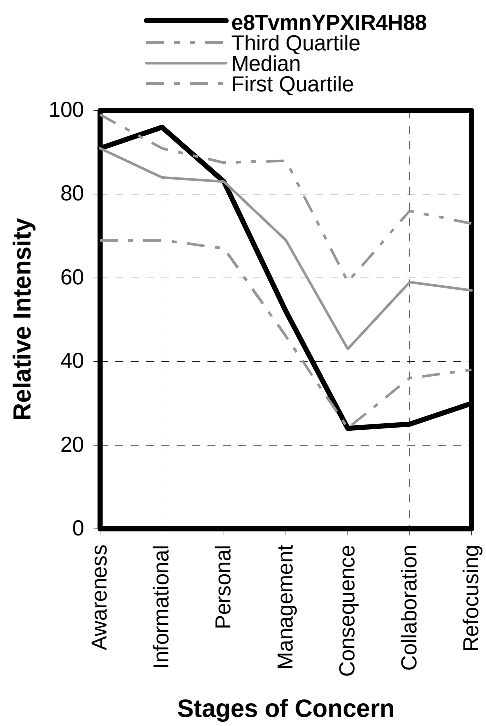
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	No
Training during 2000-2004	No
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	100%



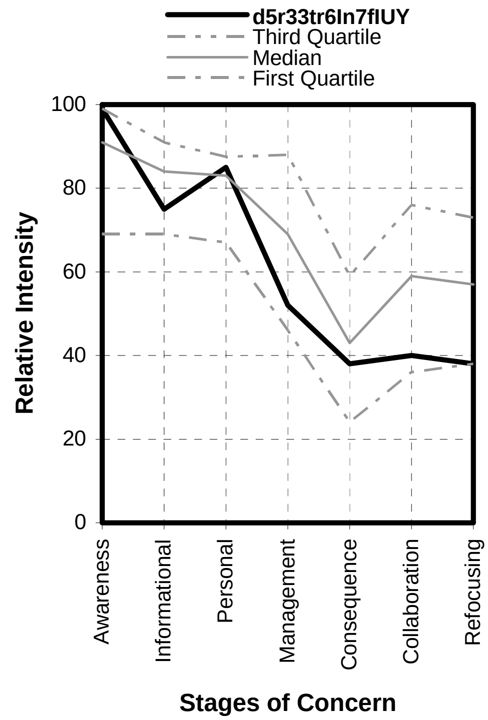
Gender Male
Age 50-59
Years Teaching 26+
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification B
Technology & Engineering FTE% 17%



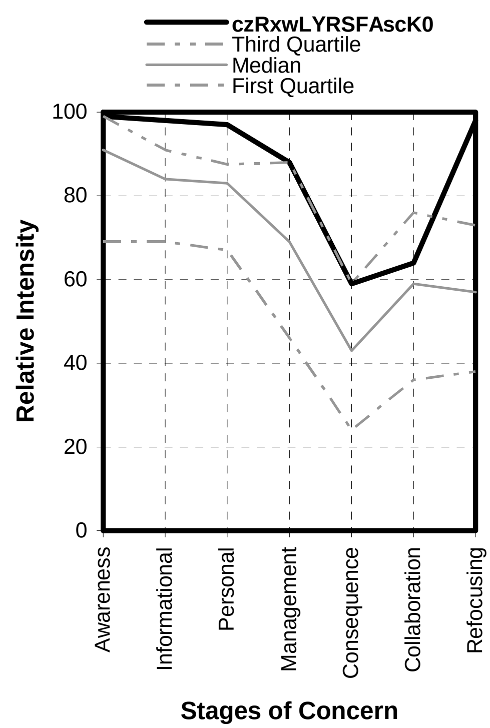
Gender Male
Age 50-59
Years Teaching 26+
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 57%



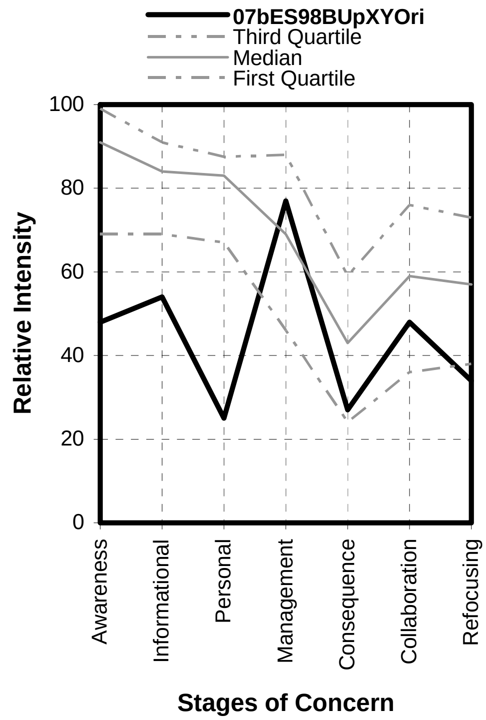
Gender Male
Age 30-39
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 33%



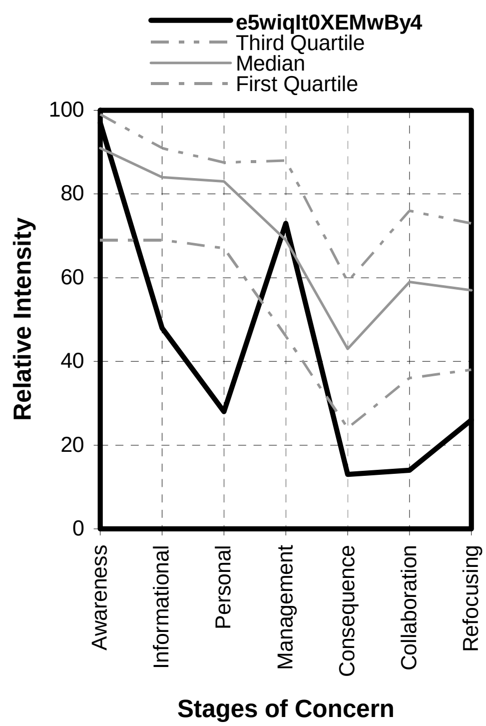
Gender Male
Age 20-29
Years Teaching 1-5
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Senior High
District Classification E
Technology & Engineering FTE% 17%



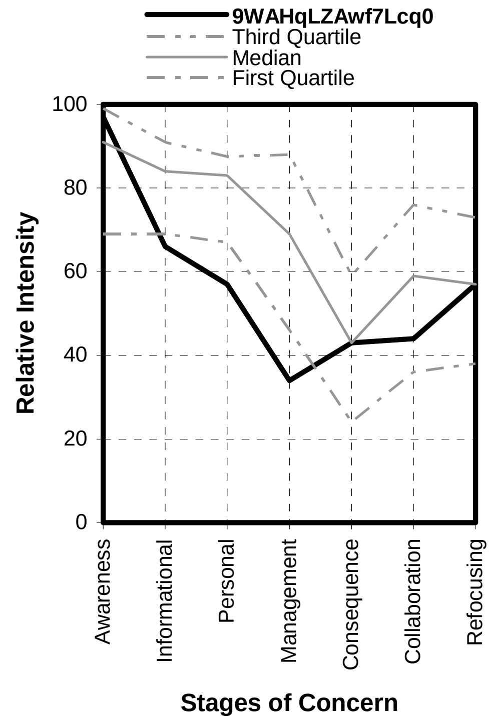
Gender	Male
Age	40-49
Years Teaching	1-5
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	104%



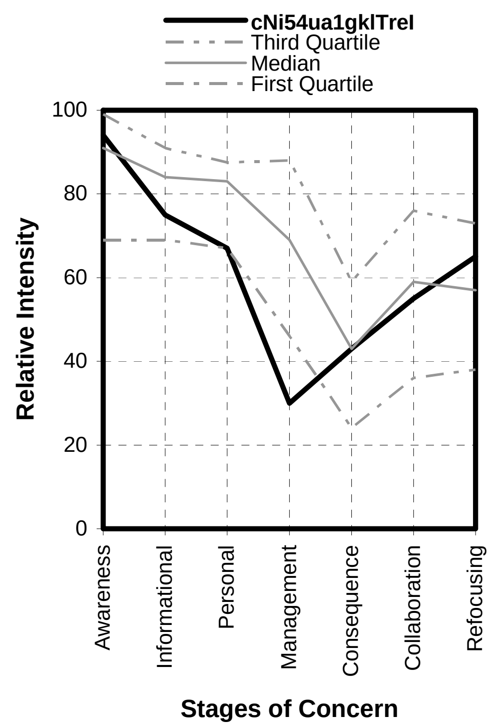
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	44%



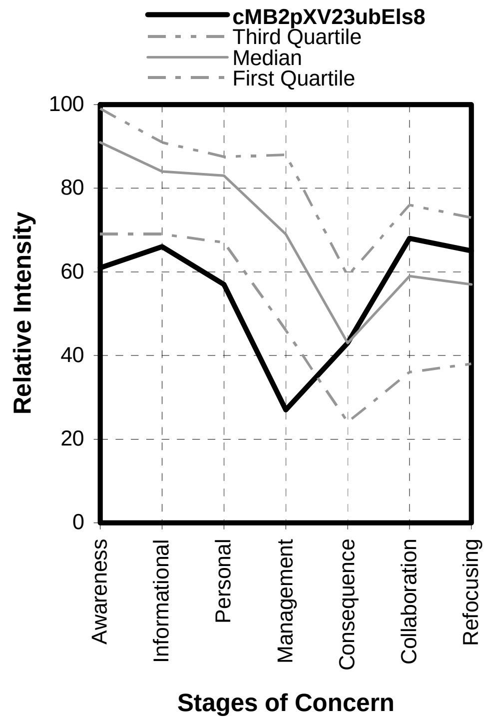
Gender Male
Age 30-39
Years Teaching 6-10
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 83%



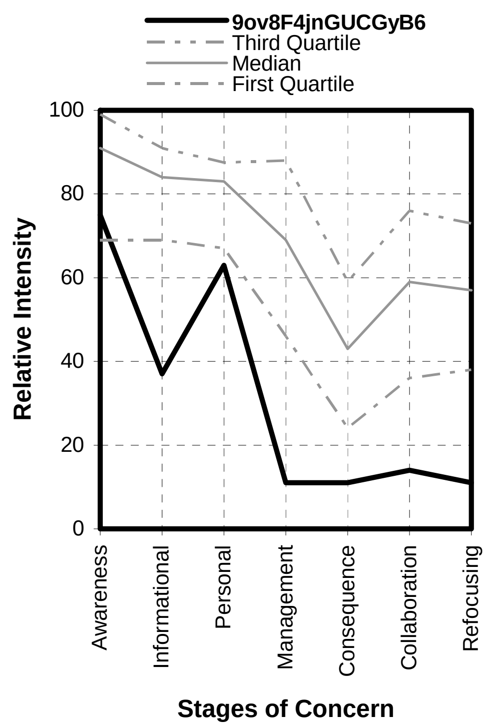
Gender Male
Age 30-39
Years Teaching 11-15
Highest Degree Earned Masters
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 14%



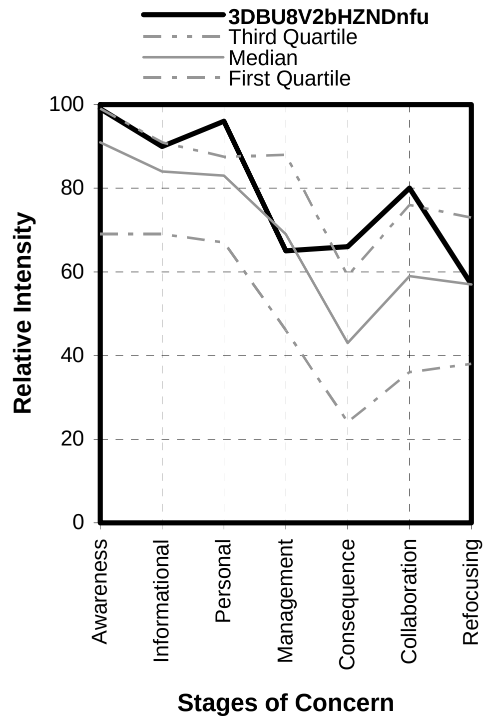
Gender Male
Age 60-older
Years Teaching 16-25
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 No
Type of School Senior High
District Classification D
Technology & Engineering FTE% 71%



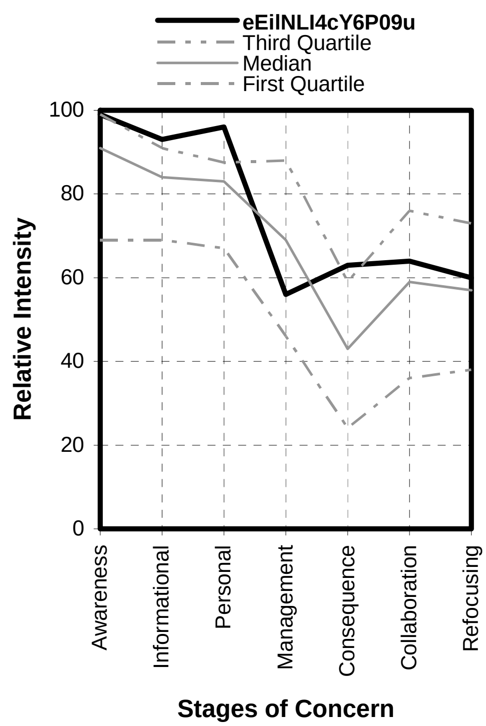
Gender Female
Age 60-older
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 No
Training during 2000-2004 No
Type of School Senior High
District Classification C
Technology & Engineering FTE% 17%



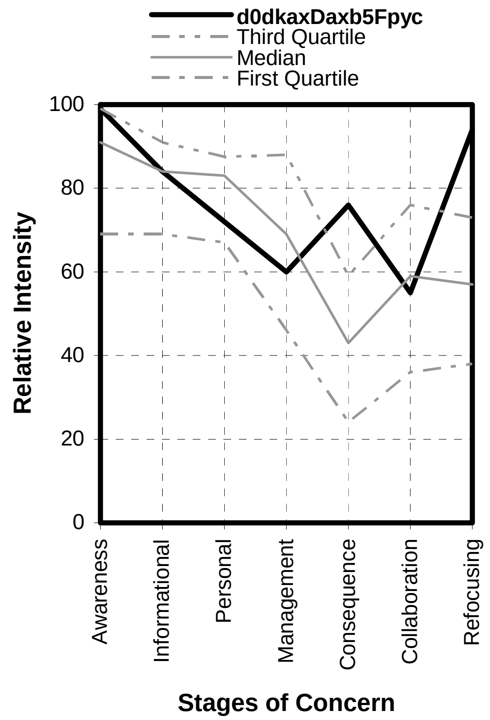
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	50%



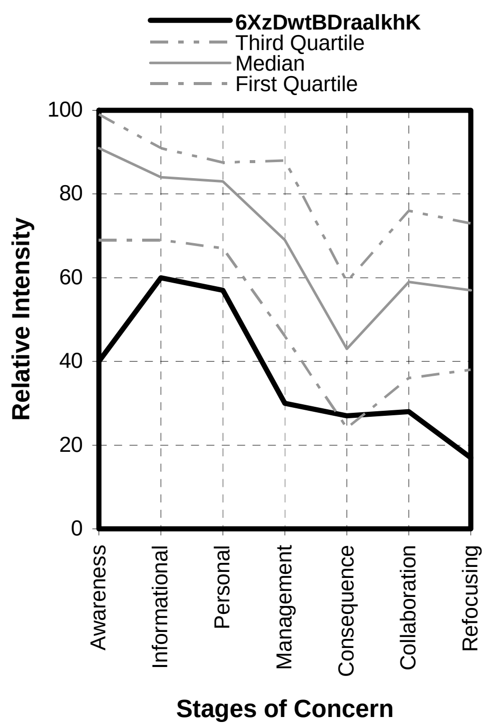
Gender	Male
Age	30-39
Years Teaching	6-10
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	34%



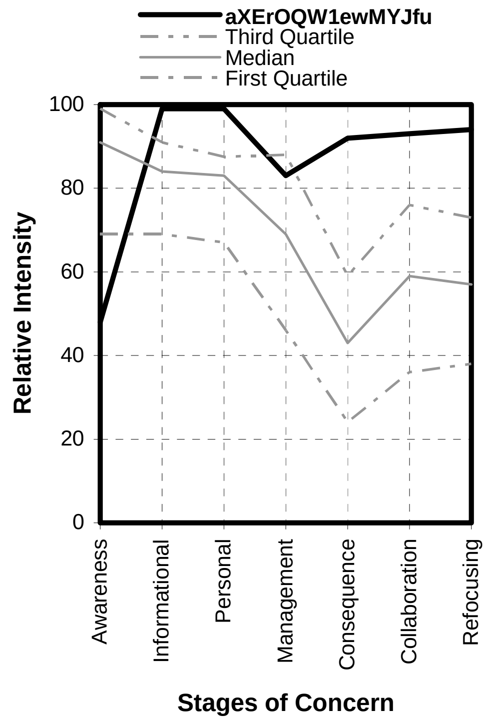
Gender	Male
Age	40-49
Years Teaching	6-10
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	A
Technology & Engineering FTE%	46%



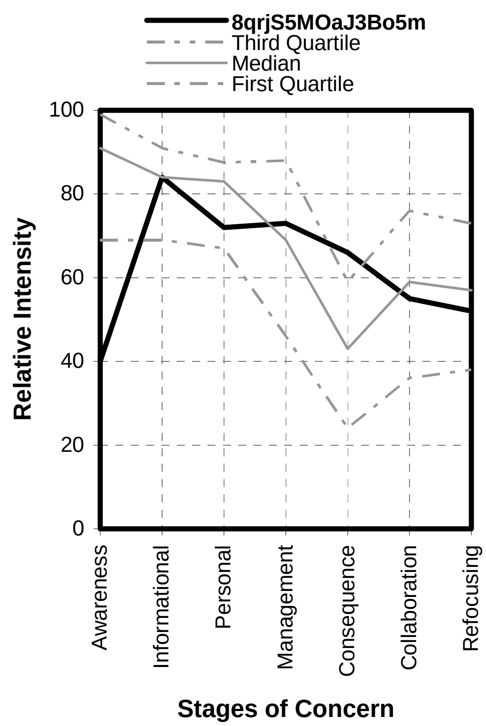
Gender	Female
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	75%



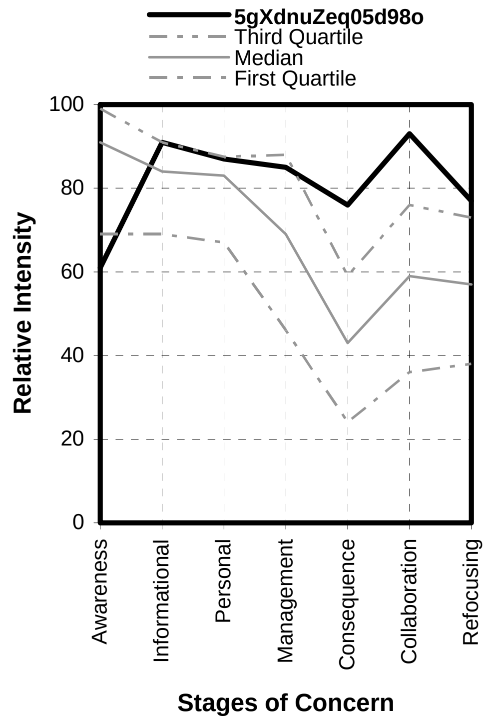
Gender	Male
Age	40-49
Years Teaching	6-10
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	27%



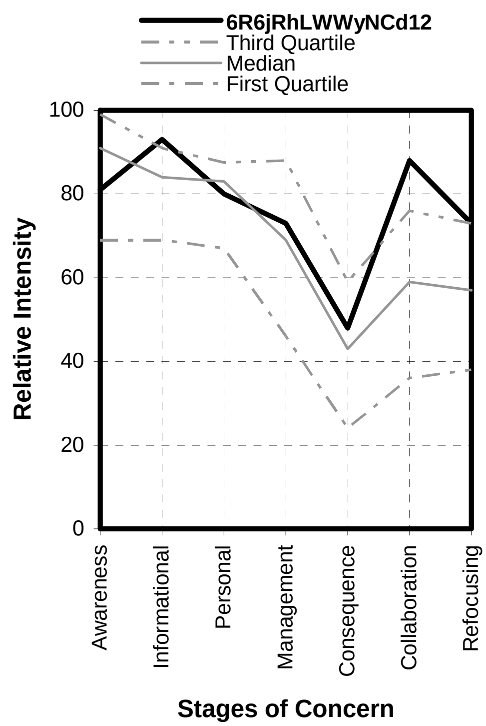
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	87%



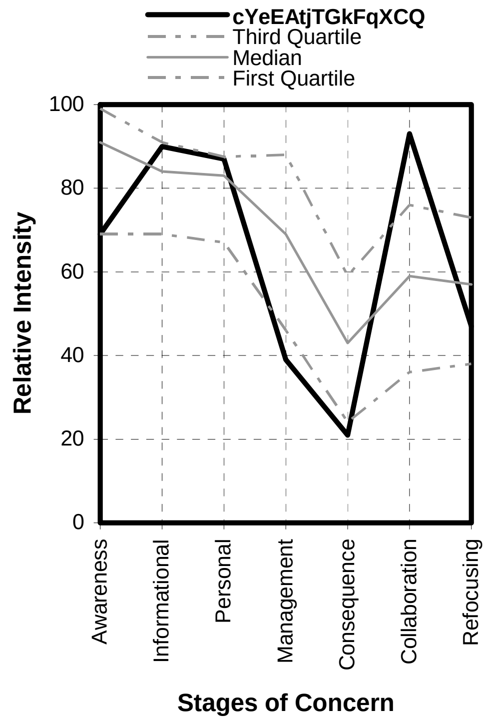
Gender	Male
Age	50-59
Years Teaching	26+
Highest Degree Earned	Doctorate
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	50%



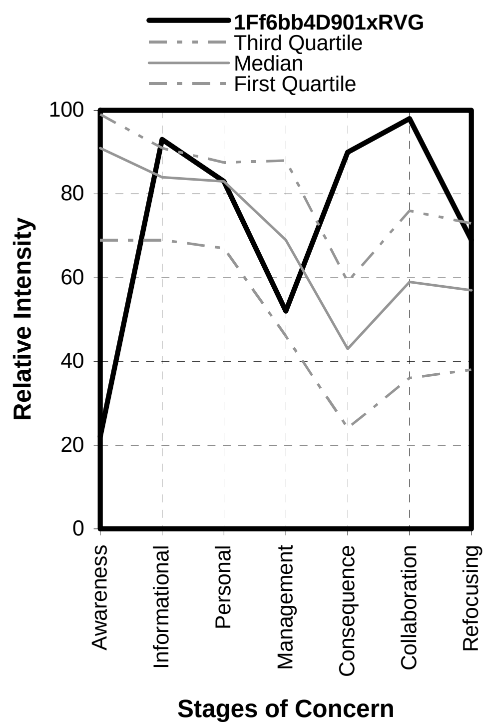
Gender	Male
Age	50-59
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	B
Technology & Engineering FTE%	50%



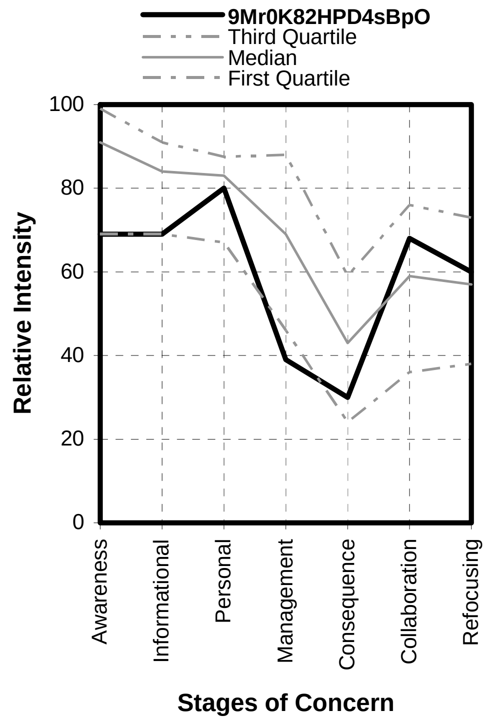
Gender	Male
Age	40-49
Years Teaching	6-10
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Middle/Junior High
District Classification	D
Technology & Engineering FTE%	92%



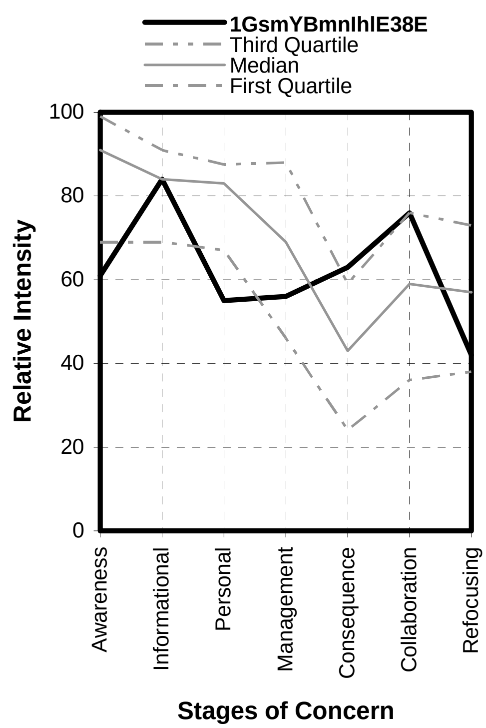
Gender	Male
Age	30-39
Years Teaching	11-15
Highest Degree Earned	Bachelors
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	100%



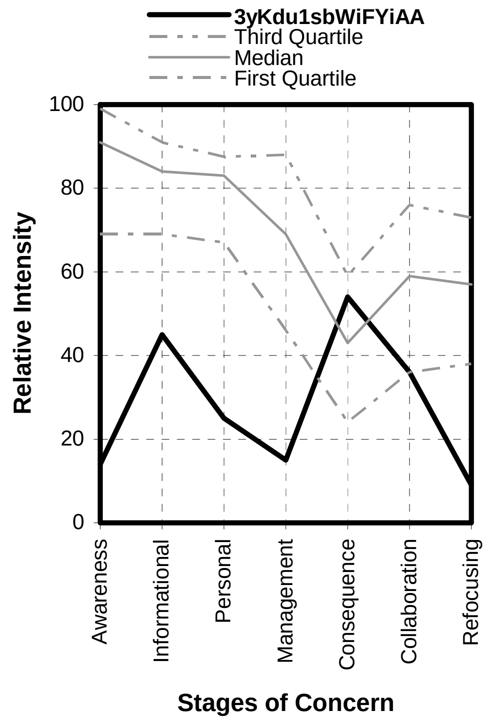
Gender Male
Age 30-39
Years Teaching 6-10
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification D
Technology & Engineering FTE% 100%



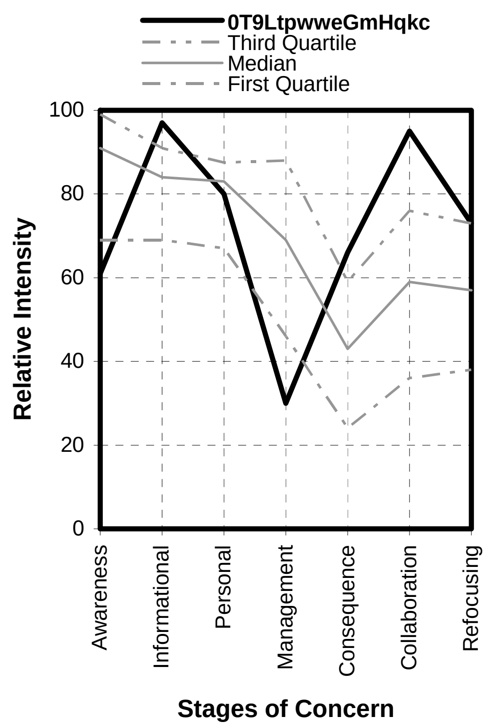
Gender Male
Age 40-49
Years Teaching 16-25
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification B
Technology & Engineering FTE% 67%



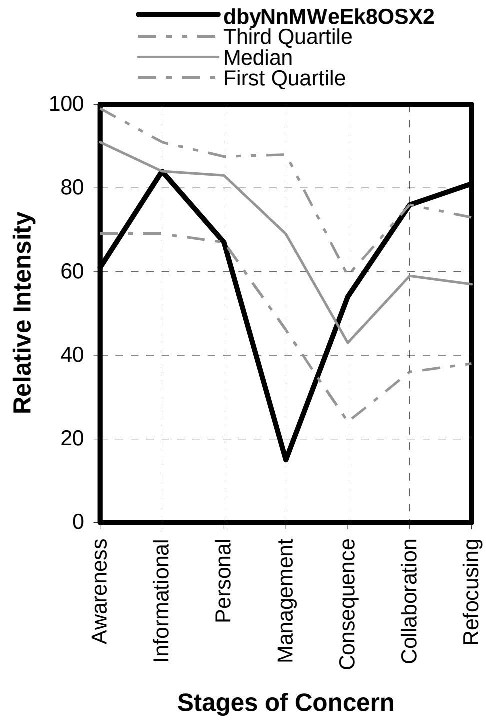
Gender	Male
Age	60-older
Years Teaching	26+
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	E
Technology & Engineering FTE%	84%



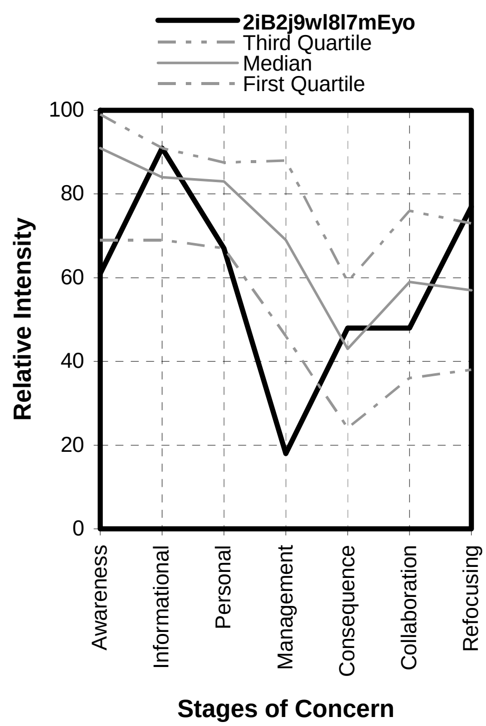
Gender	Male
Age	50-59
Years Teaching	16-25
Highest Degree Earned	Masters
Training during 2009	No
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	C
Technology & Engineering FTE%	10%



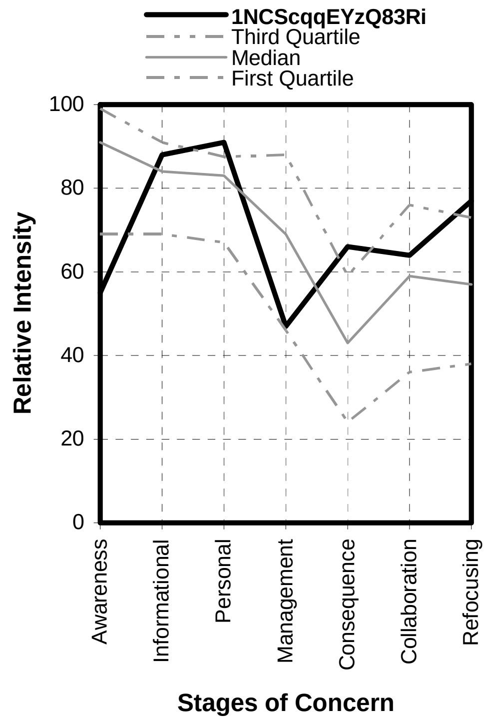
Gender Male
Age 60-older
Years Teaching 16-25
Highest Degree Earned Doctorate
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification C
Technology & Engineering FTE% 10%



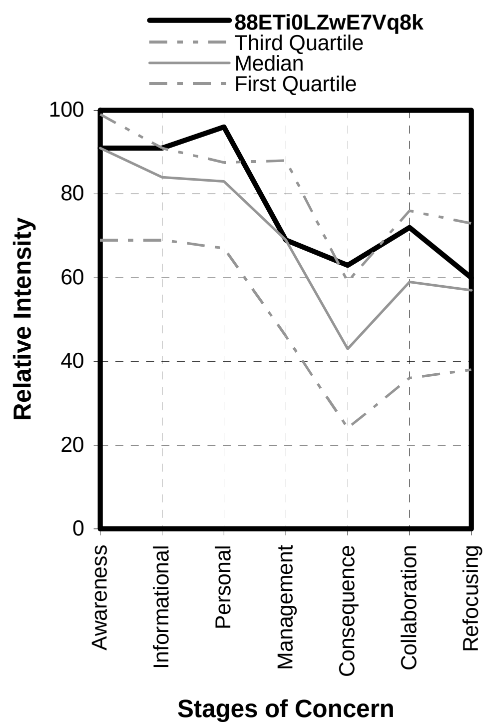
Gender Female
Age 50-59
Years Teaching 26+
Highest Degree Earned Bachelors
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification E
Technology & Engineering FTE% 40%



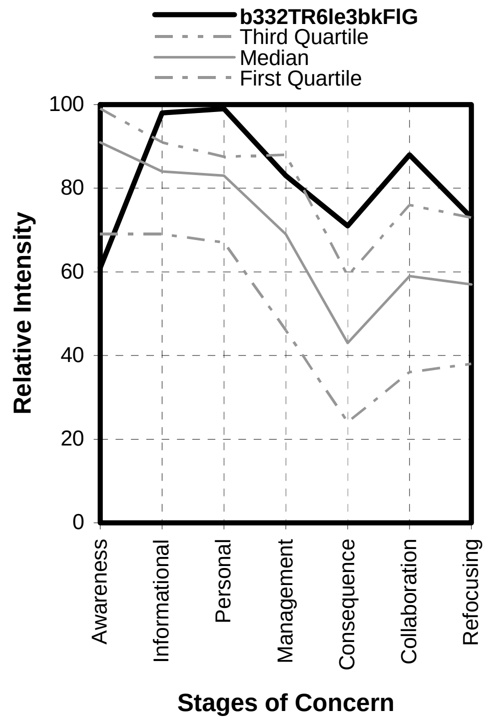
Gender Male
Age 30-39
Years Teaching 11-15
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Senior High
District Classification C
Technology & Engineering FTE% 86%



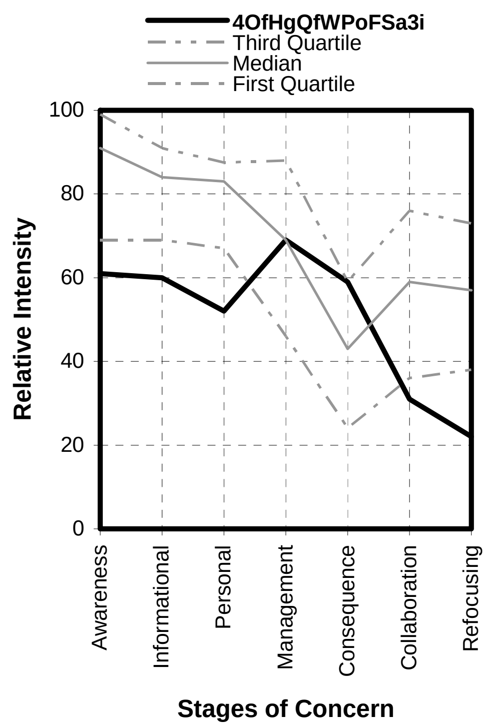
Gender Male
Age 30-39
Years Teaching 6-10
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification C
Technology & Engineering FTE% 105%



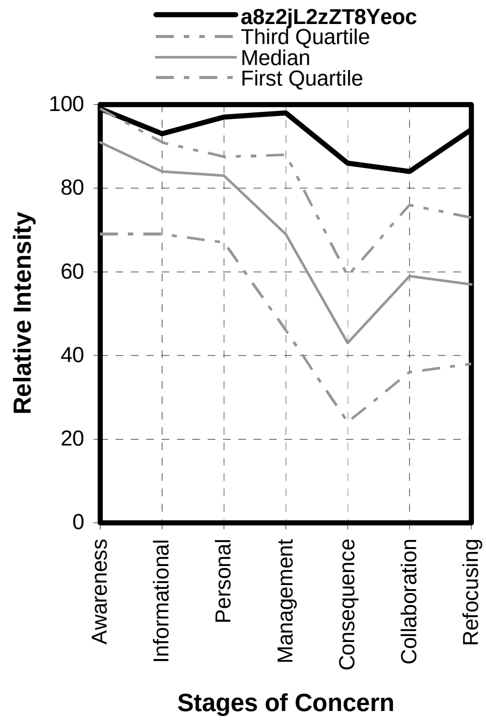
Gender	Male
Age	40-49
Years Teaching	11-15
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	E
Technology & Engineering FTE%	53%



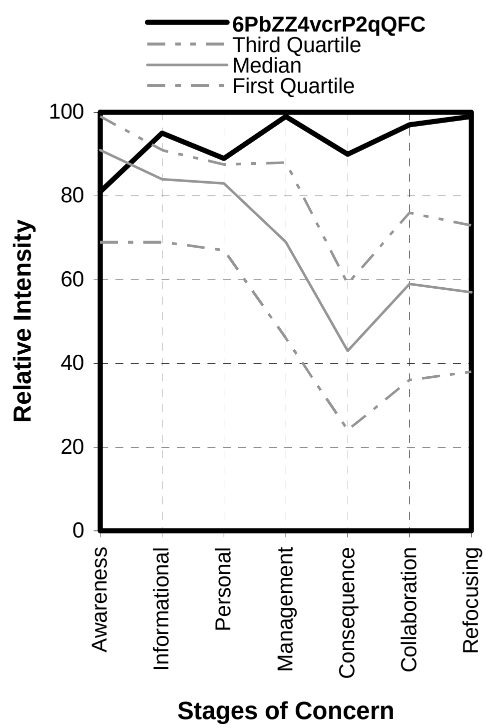
Gender	Male
Age	20-29
Years Teaching	1-5
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	No
Type of School	Senior High
District Classification	D
Technology & Engineering FTE%	83%



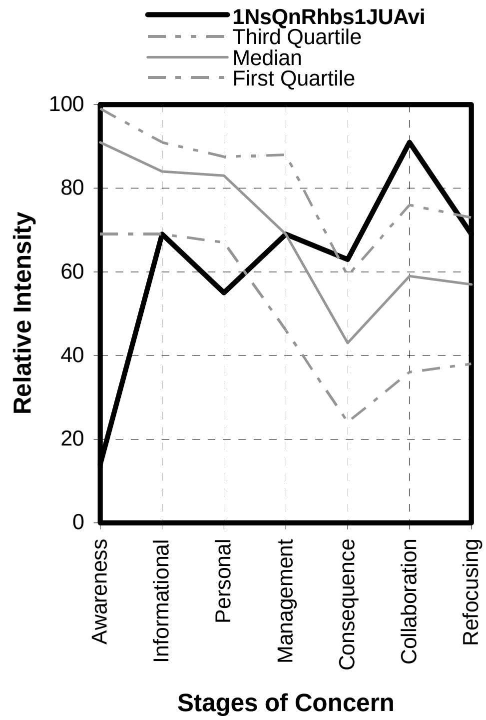
Gender	Male
Age	40-49
Years Teaching	16-25
Highest Degree Earned	Bachelors
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Senior High
District Classification	B
Technology & Engineering FTE%	75%



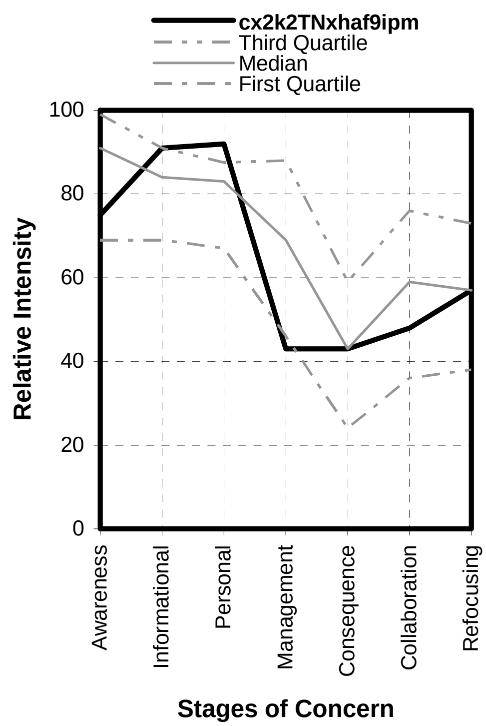
Gender	Male
Age	40-49
Years Teaching	16-25
Highest Degree Earned	Masters
Training during 2009	Yes
Training during 2005-2008	Yes
Training during 2000-2004	Yes
Type of School	Middle/Junior High
District Classification	C
Technology & Engineering FTE%	53%



Gender Male
Age 60-older
Years Teaching 26+
Highest Degree Earned Masters
Training during 2009 No
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 34%



Gender Male
Age 30-39
Years Teaching 6-10
Highest Degree Earned Bachelors
Training during 2009 Yes
Training during 2005-2008 Yes
Training during 2000-2004 Yes
Type of School Middle/Junior High
District Classification E
Technology & Engineering FTE% 20%



Appendix F. Free Responses

If look at the history of Technology Education the name changes have always followed the curriculum change. This name change is not and should not drive any curriculum change. This name change is simply a better way of describing what we are currently teaching.

I do feel it is an important part of Technology Education. Most of us do the steps of engineering without even thinking about them or know that we already do them.

I teach Jr high. I emphasize that technology is the practical application of all of the things learned in all other classes. Engineering is a part of technology, just as is agriculture. My goal is to help my student be productive citizens.

There is a place for both engineering based and technology based education. It is important that we keep both viable because there will be some students that simply don't have the intellectual ability to progress to engineering. However, if CTE does not have an engineering focus we will be losing some of the brighter students to other programs that will not give them the experience they need to be effective engineers if they even decide to move in that direction.

I believe Engineering is already included in what I do. I think more emphasis can be placed on the engineering. However, not every student that comes through our program is going to be an engineer! We need to teach for all the children. Introducing some engineering in 7th grade, is needed but it should not take front and center stage. I also believe we still have an identity problem. I still believe that many teachers are still trying to do Industrial Arts and not Technical Education. This is the major problem that we have. In conclusion I think that the State Office has dropped the ball in the 7th grade program by not updating the CTE intro web site. I have written many pieces of curriculum that has been adopted by the State that have not been put on the state office site.

An ideal program involving engineering would need to incorporate multiple disciplines collaborating on curriculum such as math, science and technology. Middle schools are placing a very high priority on collaborations of this kind, but the logistics of it are near impossible with such differing state core curriculum. Curriculum and core standards need to first be aligned at all levels to make this truly an effective and viable program. There's a lot of red tape that would have to be cut through first and making it near impossible without cooperation from educators, administrators, and even politicians. I feel this is a great way to promote the CTE programs and reestablish ourselves as a necessary discipline in education.

I am very pro the move toward engineering. However I feel that in my district and in CTE in general there is little or no connection to our high school programs. If we had Project Lead the Way in place in our district I feel that the Engineering emphasis would have more fluency from middle school to high school. As it is now students get it at my level and then nothing.

The challenge that I have is that I am close by <omitted> University and I have been trying for many years to work with the Engineering and Technology department to take the engineering class that I teach and improve upon what I teach. There has been a lot of talk but not a lot of action and I am frustrated. I know that I might have some problems with concurrent enrollment, but I need help to improve what I am teaching. As a school district we can not afford Project Lead the Way and need other ways to teach engineering that will prepare students for college in engineering.

I am not teaching Technology and Engineering at this time. I was suppose to, but we had to put the course off till next year because we didn't have the funds to set it up the program. Or district is trying to find the money for that program to run next year. I hope that one day I can teach this program. However for our students it would be better to use the old P.O.T. program. I would need to do more research on the new program and how you are planning on changing it.

I feel that Technology and Engineering go hand in hand. However, I think that Engineering is too focused on Mechanical things. Engineering covers a very broad spectrum. We have everything from people that design train trusses to the engineer that develops drugs. We have the sound engineers, the PIXAR Graphic engineers, and the guys that operate trains. We need to come up with a definition of engineer and then go from there. We need to look outside of the box. We have engineers that create the flow of water to your home. The computer engineer that makes sure that the firewalls are secure. What do we want to call engineering? That is the question.

I think adding the Engineering to Technology education just adds the concept that the technology has a real use and can be improved upon or used differently to solve a real problem. It encourages the attitude of using the knowledge to make the world a better place.

Only that it is a far cry from what I was trained to teach years ago. I spend a lot of time retraining myself in every new thing some outside entity thinks I should be teaching.

This whole idea is very valuable, but I'm not sure our students are properly prepared to handle it and like it. I am finding it difficult to keep my class enrollments high enough. I'm just not sure we can adequately excite them about it.

Technology Education need to lack it self to something. Technology education has nothing to do with skilled and technical science any more.

I am changing to administration and so my answers may be biased in that I will not be teaching next year.

If we are to teach Engineering why don't we have CIP codes for Exploring Engineering?

In the present FOT (Foundation of Technology) course there is not enough time in 1 semester class to cover all the information asked for by the state core. If you use the skip rock and just hit the high points there will be just enough time but to go into the concepts deeper it is not possible. I would like to see a possible science credit for Physics maybe come out of this program down the way. Training is very important, don't just say do this and then let us try it our own way.

Engineering students need to understand & model the design/problem solving process, all activities should revolve around this idea.

My pre-engineering course focuses on the engineering design process using technology as a tool. Students need to be exposed to the different fields of engineering and understand that whether you are interested in civil, mechanical, or nuclear engineering; there is a basic process that is followed. Students need to select a field and develop an authentic project in that field to experience a near real world application of engineering.

I believe that the best preparation for students anticipating an engineering career comes from taking rigorous science and mathematics courses.

From my very limited experience, I've noticed that most of my kids enjoy more hands-on activities rather than computer stuff. I thought it would be the opposite. I used a problem-solving activity where the kids had to create a raft out of note cards, tin foil, tape and paper clips that could keep 30+ golf balls afloat in a container of water, and the kids loved it! So I definitely think having hands-on, problem solving activities are important. Especially for middle schoolers, who are squirrelly and need to get out of their seats more often.

As a Tech Ed teacher for over 15 years, I've seen a lot of changes. I learned the industrial arts methods in college. The last year of my schooling, the switch was made to modular units in a variety of tech topics and computer usage areas. It seemed that the push was to pull tools, machines and building out of tech-ed classes. This was a bad move in my opinion! Students are not interested in canned-modular programs. They 'want' and need a shop environment to think, to build and to test with a take home project as the end result. The current switch to engineering in tech-ed is much closer aligned to the industrial arts processes of old where tools and machines are used to solve problems and build or test a useful take home project. Gone are the unneeded 'total-skill' based learned of industrial arts and 'in' are the problem solving and engineering based methods. I think engineering in tech-ed is the right direction for current education. The 'shop' experience is back in tech-ed. *One concern I have is the personal lack of skill, in high mathematics and physics areas that 'true' engineers have. How can I teach these topics if I don't know them? I'm not an engineer but I use and teach the engineering method.

Consulting what the students and parents interests are may be of some value in the development of a technology and engineering program. Successful teachers may also be of some value as a resource to higher education in the design of a viable program. My experience has indicated that high school students love to design and make things. Technology and engineering course work can be easily designed around this interest. I have also found the higher education is rarely interested in what is really happening in the trenches.

Engineering Education should not replace the traditional technology courses of manufacturing, communication, construction, power, energy and transportation. CTE pathways should include Technology Education and Engineering Education. Educators need to understand and convey to clientele that these two programs are related but also have their unique and individual qualities particularly when it comes to a student and their career. We short change our profession when students don't see the full value of both sides (technician/skilled laborer and engineer) individually as well as collectively and turn from the program because it is either more or less than they expect.

I have been teaching pre-engineering for the last 7 years with project lead the way. Engineering in the secondary is a career pathway we SHOULD be teaching!

1. Many interested students turned off by the math requirements and math TEACHERS. Non-academics hate it. Math needs to taught differently, period!

2. Nothing is said of tool & die makers, mold makers, CNC machinists and CAD/CAM operators. they are more critical than the engineers. Anybody can sketch out something or copy somebody elses design to be made. It takes real talent and skills to make it!!! I know, I have done both!

3. No practical experience among high school teachers with real world design, engineering and MANUFACTURING skills. High school - college - high school, practical experience none.

4. Too many teachers with master's degree's in high school that can't do trig or higher math. Gets you more money and status and bragging rights which of course is more important in today's world. Just ask Ivy league business grads that work for AIG if you can find them.

5. Every drafting or pre-engineering teacher needs to have worked in machine shop or auto shop to understand what is going on. German engineers are required to have real world experience in industry as part of their degree requirements.

6. Russia has plenty of engineers and physicists but they could not manufacture miniature ball bearings for guidance systems for their missiles. It took them many years to finally get a Bryant bearing grinder from the United States to make them. The first time they tried to get the Bryant grinder congress stopped them, the second time Henry Kissenger, former secretary of state okayed it! Same thing with their tanks, German-designed engine and American factories built in United States then torn down and transferred to the Soviet Union prior to WW2, Also erected by Americans.

7. Too many engineers going into the profession because of the money, not the joy of designing or building something to last of high quality. These people make poor engineers. One engineer turned down multiple engineering jobs after graduation because of a job offer as an insurance salesman with a lucrative high salary!

8. Every Technology and pre-engineering teacher should read Fedden, the life of Sir Roy Fedden, Rolls-Royce Heritage trust No 26. Basically a technician and draftsman that designed and built some of the best aircraft engines in the world prior to WW2. Definitely should be required reading!!

9. One of the best tool & die and mold makers I know is of Norwegian decent with a high school education (not a dumbed down excuse like today) that learned the trades from two Germans in Seattle that learned their trade in Germany prior to WW2. We work together making miniature engines. He is 78 and I'm 55.

10. We use Keycreator, Surfcam, Pro-Engineer, Rhino to design and machine things out and make molds.

I am teaching in a PLTW engineering program. I feel it is a wonderful opportunity for students who are considering the engineering world for their future. It is not for every student.

Some Engineer's I have dealt with have little to know practical use of their education and it often has been counterproductive to have an engineer on the job. If our students don't get some technical experiences in high school they won't make the real world connections in the Engineering classroom.

I love the new focus! The major problem that you have not addressed in your survey is the reality of the limited academic value of CTE classes toward high school graduation and college/university entrance. It is an elective and does not count as important as math and science. In our school the CTE Technology class has become a "baby-sitting" class for behavior-problem students...they are typically not interested in the more difficult content of engineering. This is becoming an issue with the counselors that schedule and direct students in their registration. Engineering and Technology are critical to the students, but at the school level are not considered in the domain of CTE, but rather Math and Science. I perceive the major issue is administrative (district and state level) acceptance of CTE as a viable department to provide engineering training.

I currently teach engineering concepts in my Technology Education classes such as problem solving, technical drawings, prototyping, etc. My concern in increasing the emphasis on Engineering is that you are going to start excluding students. Traditionally Technology Education has appealed to students who didn't necessarily want to get a 4 year degree. In my mind Technology Education is for students who want to work hands on, and will likely get a 2 year degree, specialized training, or on the job training. Likewise, I believe that engineering is more geared towards book learning, with more math, physics, etc. than the typical Technology Education student wants. I would like to see a variety of classes to choose from, with the current Technology Education classes offered, and Engineering classes offered as upper level classes. Some of the questions had to do with time and resources. Currently I have plenty to do to keep my programs running. I'm OK with implementing a new program as long as extra time and resources are provided, otherwise I'm not interested.

I believe that a falling away from vocational training and education has had a direct detrimental effect on the nation’s economy and current status. I believe that training our best and brightest to detest dirt under the fingernails is a turning point in our society that will lead to ultimate failure. Here again we are teaching 80% of our students for 20% of the jobs. Those who desire to become engineers should build others designs first in high school. Students should learn from the ground up and have a dose of hard work before sitting in the design chair. We are getting in too big of hurry to push high school kids to be wise and intelligent college graduates without laying a proper foundation. How many young engineers have ever cranked a wrench or hung upside down in a harness to do a vertical weld? How many Architects can sink a 16d nail with no more than a couple of hits with a 22oz framing hammer? How many times has an HVAC contractor gone to install a ducting only to find that there has been no consideration for duct work in the plan? I believe the best engineers are those who have a firm foundation of the tools, practices, and common sense of the trades that will ultimately be working the design. We can inject engineering into vocational education and encourage students to seek a college education in engineering, but not without laying a good foundation of work ethic and common sense first.

It is vital that we do something to update this program because of the increased requirements for graduation. This factor resulting in students having less time to explore elective courses and therefore cutting the number of students taking technology classes as an educator this is a huge concern. We need to bring those students into these CTE courses to keep this program alive.

You need to define higher level math. I have a Manufacturing engineering degree and have taken calculus but in industry I have only used Trig..

As a professional engineer who found his way back into engineering education, I am constantly surprised at the lack of student skills in the 'Other' box I included above. Students arrive at my Introduction to Design Engineering course with good math skills, for the most part, but zero application skills. Students exhibit a smattering of mechanical engineering understanding mixed with some basic physics but can't read a ruler or use a set of calipers. I focus on basic problem solving skills, elements of design and the application of technical software that aid in the creative process. My impetuous at present is incorporating advanced classroom technology in the presentation of curricula by use of multimedia approaches and Promethean intelligent board approaches. Today's engineering instructors must be able to match the pedagogical needs in the classroom with the advanced awareness secondary students possess relative to computers, software and digital communication appliances which are important of the lives of these students. Modern pre-engineering students, and most other students, are visual learners with the Zone of Proximal Development (Vygotsky) somewhat narrowing. Students bring into their engineering academic environment excellent software manipulation abilities and very adequate general computer skills. It is the challenge, therefore, of the engineering instructor to rise to the level of potential of today's very bright youth pointing them towards that world that doesn't yet exist that they will build. Engineering principles could be incorporated in most area of study and bring to that academic thread an enhanced learning experience for the modern student. Language Arts, History and Geography, Business, and Technical writing courses could be greatly enhanced with the adaptation of design process and problem solving principles taught in good engineering courses. Finally, I struggle with the fact that most students are very poor writers in general and very inadequate in creating pieces of technical writing specifically. Engineering principles which include effective communication using all types of media and method while presenting engineering concepts, again, should be blended into the curricula of 'outside of engineering' areas of study.

Our state needs a defined curriculum, not a prescripted one like Project Lead the Way but a good set of standards and objectives that come from research. I am impressed with ITEA's process to create those standards and objectives.

Not the right direction for middle/ junior High students.

I think we where doing fine with out all the Engineering. We had students that became Engineers before the big push.