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Educators' Resistance to the Technology and Engineering Education Transition

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By Kenneth L. Rigler Jr.

ABSTRACT

The purpose of the qualitative grounded theory study was to explore why industrial arts educators resisted organizational change to technology and engineering education. An exploratory, grounded theory method was used to identify new theory related to educators' resistance because the current literature did not provide a theoretical perspective about why industrial arts educators have resisted the change. The sampling frame was derived from a database of 379 secondary technology and engineering education teachers in the state of Kansas, and a sample size of 13 participants was needed to reach theoretical saturation of the phenomenon. The data for the study was collected through observations and face-to-face semi-structured interviews with in-service industrial education teachers. Data collected from the observations and interviews were analyzed using the three-phase classic grounded theory coding technique. Data analysis and interpretation resulted in the emergence of three substantive theories related to the study phenomenon: (a) inefficacious transition to technology and engineering education, (b) value for technical learning, and (c) industry demand-based change.

keywords: educator resistance, technology education, engineering education, industrial arts, grounded theory

EDUCATOR RESISTANCE TO THE TECHNOLOGY AND ENGINEERING EDUCATION TRANSITION

Technology and engineering education is a school discipline that has a century-long history of being redefined (Asunda & Hill, 2008). With each transition, the theoretical place and purpose of the discipline within the schools has been modified, which has created a growing gap between the discipline's theory and practice (Lauda, 1984; Wright, Washer, Watkins, & Scott, 2008). Even though program titles within the discipline have changed from industrial arts to technology and engineering education, there are still a significant number of secondary industrial arts educators who continue to teach from a traditional industrial arts curriculum (Kelley & Wicklein, 2009; Spencer & Rogers, 2006), and as a result they have resisted this transition (Sanders, 1997; Spencer & Rogers, 2006; Wright et al., 2008). Despite significant efforts from the International Technology and Engineering Education Association (ITEEA) to establish technology education as a broad-based academic core discipline for technology literacy, it has often remained as an elective under the umbrella of career and technical education (Dugger & Johnson, 1992; Wright et al., 2008). These discrepancies have created division among professionals in the field and confusion regarding the overall purpose of the discipline (Katsioloudis & Moye, 2012; Wicklein & Hill, 1996).

LITERATURE REVIEW

The highest ranked future critical problem for the technology and engineering education discipline reported by Katsioloudis and Moye (2012) was related to school counselors who did not understand technology and engineering education. This was not surprising because Kelley and Wicklein (2009) emphasized that technology education has a history of generating new program titles with little curricular changes. What started as manual training in the 1880s changed to manual arts in the early 1900s, then to industrial arts in the 1930s, then to industrial technology in 1970s, then to technology education in the 1980s, and then most recently to technology and engineering education in the 2000s. As the curricular focus and content has been modified with each name change, it has created ambiguity and confusion for all stakeholders involved in the discipline (Katsioloudis & Moye, 2012).

Technology Literacy as the Curricular Focus

Around the turn of the 21st century, the International Technology Education Association (ITEA) developed multiple publications to clearly articulate its purpose and focus for the discipline centered on educating all students for technology literacy. Relating to technology literacy, Ritz (2009) conducted a Delphi study with the ITEA leadership board with the purpose of articulating goals for the K12 technological literacy programs. The top five essential goals for technological literacy programs identified in the study included:

1. Describe social, ethical, and environmental impacts associated with the use of technology.
2. Become educated consumers of technology for personal, professional, and societal use.
3. Apply design principles that solve engineering and technological problems.
4. Use technological systems and devices.
5. Use technology to solve problems. (Ritz, 2009, p. 59)

A comparison between Ritz's (2009) study and the data collected by Bame and Miller (1980) as part of the Standards for Industrial Arts Programs project clearly articulated the differences between the former industrial arts purposes and the modern goals for technology education. In the Bame and Miller (1980) study, the middle and high school industrial arts teachers identified the top two purposes for industrial arts as (a) to develop skill in using tools and machines and (b) provide technical knowledge and skill. The emphasis of the industrial arts curriculum was clearly on skill development, whereas the top technology goals were focused on broad-based, knowledge-oriented concepts relating to technological literacy.

Engineering Design as the Curricular Focus
Throughout the 21st century, during the same time the ITEA leadership was articulating the discipline's role and purpose in teaching technology literacy, the leadership also began to introduce an additional curricular focus for technology education—engineering (Asunda & Hill, 2008; Pinelli & Haynie, 2010). In 2010, the ITEA changed its name to the International Technology and Engineering Educators Association (ITEEA) with the purpose of incorporating engineering education into the technology education curriculum (International Technology and Engineering Educators Association, 2010). To help clarify the relationship between technology and engineering, Custer, Daugherty, and Meyer (2010) conducted an emergent qualitative study and identified 13 engineering concepts generated from over 100 original themes. The study helped identify that in order to appropriately integrate a focus on engineering education, the curriculum would need to incorporate a higher level of scientific and mathematical concepts particularly in the areas of statics, dynamics, thermodynamics, stresses, deflections, and loads (Custer et al., 2010).

Career and Technical Education as the Curricular Focus
Career and technical education, formerly known as vocational education, has had a very real, yet covert relationship with technology and engineering education. The hidden relationship has most notably been due to the fact that the leaders of the technology and engineering education have worked for decades to differentiate and separate the two content areas (Kelley & Wicklein, 2009). However, the evidence from the literature has demonstrated a connection between technology and engineering education teachers and career and technical education (Kelley & Kellam, 2009; Moye, Dugger, & Starkweather, 2012; Wright et al., 2008). Many state departments of education have categorized technology and engineering education as a sub-category under the umbrella of career and technical education for several decades (Dugger & Johnson, 1992; Moye et al., 2012; Spencer & Rogers, 2006).

Another example of the relationship between career and technical education and technology and engineering education surfaced in Kelley and Wicklein's (2009) study as they examined the inclusion of engineering design in technology education's curriculum. The participants reported that the application of engineering design through the development of basic skills using tools was emphasized and not the application of math and science. Kelley and Wicklein (2009) interpreted this emphasis to indicate that a significant percentage of technology educators had not transitioned to the recommended broad-based engineering design curriculum and instead emphasized tool skill development more closely related with career and technical education.

The breadth of curricular focuses including technology literacy, engineering education, and career and technical education has created division amongst the professionals in the field and confusion as to the overall purpose of technology and engineering education (Katsioloudis & Moye, 2012; Wicklein & Hill, 1996). The quantitative results in the literature have indicated that a significant number of secondary industrial arts educators have resisted the transition to technology and engineering education and have instead continued to teach from a traditional industrial arts curriculum (Kelley & Wicklein, 2009; Spencer & Rogers, 2006; Wright et al., 2008). However, there are gaps within the literature providing an explanation as to why the educators have resisted the transition to technology and engineering education.

METHODS

The purpose of this qualitative grounded theory study was to explore why the industrial arts educators resisted the organizational change to technology and engineering education. Consistent with a grounded theory research design, the study was broadly guided by the following research questions:

Q1. What types of resistance have the Kansas industrial arts educators demonstrated toward the transition to technology and engineering education?

Q2. Why have the Kansas industrial arts educators resisted the organizational change to technology and engineering education?

An exploratory, grounded theory method was used to identify new theory as it allowed for the collection of the thoughts and feelings related to the educator resistance to change (Corbin & Strauss, 2008; Patton, 2001). A grounded theory research design is often used for the purpose of building theory rather than testing it (Glaser & Strauss, 1967; Urquhart, 2013), and it was most appropriate for the current study because the current literature base did not include a theoretical perspective for this phenomenon. The target population for the study was licensed industrial arts and/or technology education teachers in the state of Kansas who were currently teaching a traditional industrial arts-based program with a minimum of five years of teaching experience. The criteria for a minimum of five years of teaching experience was established in order to obtain the beliefs and values of experienced educators who were trained before, during, and after the transition from industrial arts to technology education. The sampling frame was derived from a database of 379 secondary industrial arts/technology education teachers in the state of Kansas. Maximum variation purposeful sampling and theoretical sampling techniques were used to increase the potential for naturalistic generalization and extrapolation of the study findings (Patton, 2001) and to select participants that provided related variations to the concepts emerging in the data (Corbin & Strauss, 2008).

As recommended by Corbin and Strauss (2008), semi-structured interviews were utilized for the grounded theory study to provide a degree of consistency and organization from one interview to the next, and they also allowed the flexibility needed to properly investigate each unique situation. An interview guide was utilized in order to facilitate the face-to-face interviews, observational tour, field notes, and memos (Kvale & Brinkmann, 2009). The interview guide was validated via a field test with an expert panel of two professionals in the technology and engineering education discipline who reviewed it for face and construct validity. The interview guide was revised per the experts' feedback. The interviews were audio recorded and then transcribed verbatim into text files for analysis. The data was analyzed using Glaser and Strauss's (1967) and Glaser's (1978, 2005) classic three-phase grounded theory coding technique and resulted in the emergence of three substantive theories: (a) inefficacious transition to technology and engineering education, (b) value for technical learning, and (c) industry demand-based change (see Table 3).

Table 1: Teaching Experience

Experience	Frequency	%
< 9 years	1	7.7
10 - 19 years	1	7.7
20 - 29 years	9	69.2
30 - 39 years	1	7.7
> 40 years	1	7.7

NOTE: N = 13.

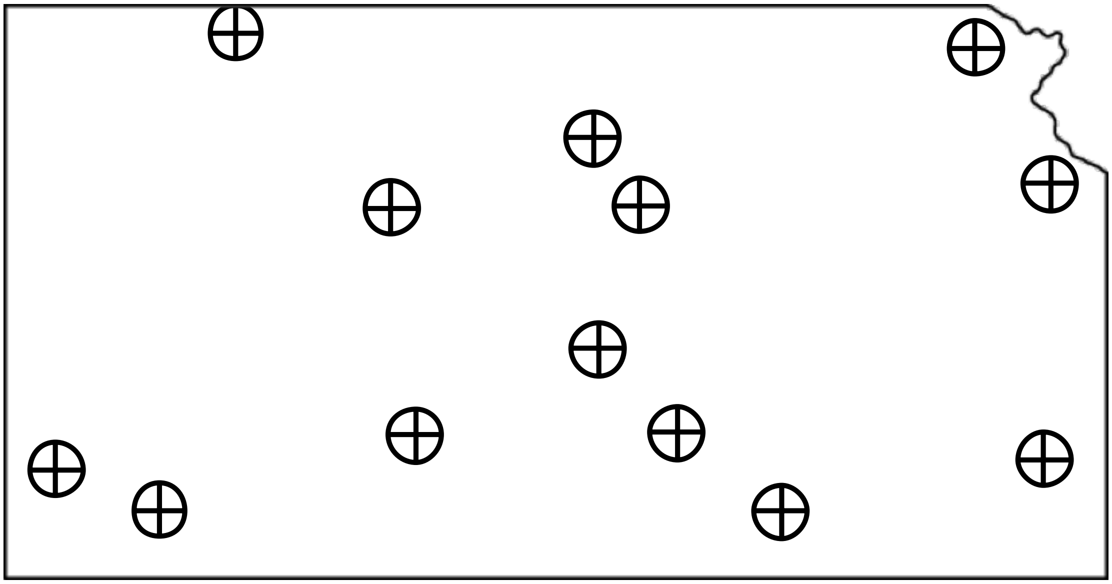

Figure 1. Approximate Locations of the 13 Interviews Conducted. Adapted from "Kansas Outline Map" by Graphic Maps, Retrieved June 16, 2014, from http://www.worldatlas.com/webimage/countrys/namerica/usstates/outline/ks.htm. Copyright 2014 by Woolwine-Moen Group. Adapted with permission.

Table 2: High School Size

Class	Enrollment	Frequency	%
1A	20 - 99 students	2	15.4
2A	100 - 154 students	3	23.0
3A	156 - 249 students	2	15.4
4A	251 - 734 students	2	15.4
5A	737 - 1336 students	2	15.4
6A	1357 - 2258 students	2	15.4

NOTE: N = 13. Enrollment numbers based on 2013-2014 Classifications & Enrollments from the Kansas State High School Activities Association. Retrieved from http://www.kshsaa.org/Public/PDF/Classifications13.pdf

Table 3: Emergent Theories for Research Questions 1 & 2

Theory	Frequency	%
1. Inefficacious transition to technology and engineering education	13	100%
2. Value for technical learning	13	100%
3. Industry demand-based change	13	100%

NOTE: N = 13.

RESULTS

Of the 379 educators who were sent an email invitation, 96 educators responded, of which 77 met the study requirements and were then categorized by teaching experience, region, and size of school (see Tables 1 and 2). Only two of the 96 respondents were female, and neither was selected through the sampling processes; thus, all participants in the study were males. A final sample size of 13 participants was needed to reach theoretical saturation of the phenomenon. Figure 1 illustrates the approximate location for each of the interviews across the state of Kansas.

Emergent Theory 1: Inefficacious Transition to Technology and Engineering Education
Though study participants described potential strengths in the technology and engineering education curriculum, their past experience with modular technology and current unfamiliarity with engineering education caused the participants to doubt the efficacy of a technology and engineering education curriculum. All 13 participants (100%) had experience in the transition from industrial arts to technology education through the modular technology initiatives, and none of the participants (0%) continued to teach using this method. The study constructs identified by participants when describing the transition to technology and engineering education included (a) exploratory, (b) short-term, (c) expensive, and (d) unfamiliar (see Table 4).

Table 4: Constructs for Technology and Engineering Education

Construct	Frequency	%
1. Exploration	7	54%
2. Short-term	10	77%
3. Expensive	6	46%
4. Unfamiliar	7	54%

NOTE: N = 13.

The participants described the modular initiative through technology education as an effective way to explore a variety of technologies and careers appropriate for students at the junior high level. Participant 8 described the modules as “exciting” where students could explore “electricity, pneumatics, small engines, all kinds of stuff, and it was great fun,” and Participant 6 said, “I think the strengths were that most of the modules kind of interested the students.”
As reported by Participant 5, “The strengths were that there were tons of things the kids could do . . . plenty of activities and projects.” However, the participants also noted that the interest and excitement was short-lived, because each modular unit only lasted one or two weeks and shared disappointment in the pedagogy of the modular programs. For example, Participant 11 reflected how the “teacher is not a teacher . . . [but] a facilitator” in a modular-based program. According to Participant 5, the teacher started the students on the first day of the module and then came back on the fifth day to check the students’ work. This type of teaching was labeled “glorified babysitting” by Participant 3; Participants 6, 8, and 13 also identified how the modular program was a challenge for classroom management, and reported problems when students finished early. Participant 13 explained, “There is such a disparity in the amount of work that [it] took to complete them. We had some students who . . . would be done in two or three days, and it’s a 10-day rotation,” while Participant 6 described the same situation when students who “were really top-notch in the class and they would finish that stuff quick. So what do you do with them then? It’s a nightmare.” Participant 8 labeled the overall experience as a “bad time.”

When describing the overall experience of the transition from industrial arts to technology education through the modular programs, the participants described concern in the initial stages and disappointment in the latter stages. Initially, the participants were concerned with schools replacing the traditional shops with the modular classrooms. For example, Participant 1 remembered a nearby school that “basically wiped out their whole woodshop . . . [and] went to all modules,” and Participant 8 reflected, “All around me I was watching all these other schools selling all their shop equipment and go to the mini modules.” Participant 13 shared:

> “I had some big concerns at one point because schools were jumping on the bandwagon of modular and just doing away with shop areas completely. No manual arts, no industrial education whatsoever. Then it seemed like some of those folks who had done away with everything backpedaled a few years later and tried to re-implement the shops again but some of them obviously couldn’t afford it.”

In some schools, the modular programs lasted approximately 10 years, but in other schools they were removed much more quickly. For example, Participant 12 reflected how the modular programs “came in fast and left just as fast as [they] came in.” Overall, the participants shared disappointment for the modular programs and when asked what the phrase technology education meant to Participant 3, the participant simply said, "I think it's a dirty word."

When asked about the potential integration of engineering within the current programs, multiple participants shared concern that it would be too expensive and not fit well with the type of students in their programs. For example, Participant 12 related the engineering expenses to those of the modular programs and didn't believe the school could afford the additional expenses needed to properly incorporate engineering into the curriculum. As for the participation in an engineering-based curriculum, Participant 2 said, "I'm not sure the students have the skill level to do it," and Participant 10 believed it would only be relevant "to a select number of our students." Participant 1 shared that an increase in engineering concepts in the program would discourage the students who need to take the technical courses from doing so because there would be an increase in theoretical concepts and a decrease in hands-on activities.

Two of the participants, both primarily drafting/CAD instructors, were open, receptive, and familiar with current engineering education. Both participants believed they were already incorporating engineering concepts into their programs. Participant 7 emphasized:

> "Well I have always been engineering . . . [and] we really haven't changed that much. If we are true to our philosophy then we have been progressing all along with technology because technology is just a facilitator. Engineering hasn't changed it's that technology has been used as a resource to help facilitate engineering.

Participants 5 and 7 articulated that a blend between industrial education, technology education, and engineering education was the best curriculum for students. They described it as a balance between knowledge-based engineering concepts and hands-on technical learning skills.

Emergent Theory 2:
Value for Technical Learning

The study participants stressed the importance of teaching technical knowledge and skills through project-based learning. All 13 participants (100%) identified with a strong value in technical learning. The participants described technical learning as broad-based educational experiences that incorporated both the knowledge and skills needed to manipulate resources into useful products. Constructs described by the participants included (a) project-based, (b) skills, (c) hands-on, (d) broad-based, and (e) life-long learning (see Table 5).

The most widely used term throughout the transcripts in relation to technical learning was the root word project (f = 96). All 13 participants (100%) incorporated projects as major components in their curriculum. For example, Participant 6 emphasized the importance for students to "still do projects that they see something from start to finish" and Participant 3 stressed, "these kids have to see something with their hands that they can create on their own, otherwise we lose them. We need to spark interest with what they're good at." The projects implemented into the programs were tangible real-world products designed, created, and kept by the students. For example, Participant 1 contrasted the difference between

Table 5: Constructs for Technical Learning

Construct	Word Frequency	Participant Frequency	%
1. Project-based	96	13	100%
2. Skills	69	13	100%
3. Hands-on	65	11	85%
4. Broad-based/exploratory	29	10	80%
5. Life-long	19	8	62%

NOTE: N = 13.

projects created in an industrial education course versus a general education course: ". . . the biggest thing about industrial education is . . . [students] come out with a project at the end that's . . . usable and you actually keep 20 or 30 years down the road," and Participant 12 said:

> "We've built a lot of stuff the kids are going to use for the rest of their life. I tell the kids to write down your name, your year, and the school on the bottom or back of your project so when your grandkids are fighting over it, they know when it was built.

Reflecting on the value of the projects, Participant 9 said, ". . . the satisfaction that I see students get here on seeing something built with their own two hands [and] the pride the parents have in the piece of furniture is priceless."

All 13 participants (100%) described the importance of teaching students some degree of technical skills. The root word skill was used 69 times throughout the transcripts. Participant 2 described the importance of applied skills and identified "the problem is that none of the kids know how to build anything and that's where we are really short in our schools. We don't have kids who know how to build stuff . . . they don't have the applied skills." Participant 9 emphasized that the students "have to have the manual skills, those hands-on skills." The participants described a strong connection between skill development and students' being employable in the future. Also related was the role education takes in teaching students skills for a future career.

Eleven out of 13 participants (85%) emphasized the importance of hands-on learning within industrial education. The root word hand was used 65 times throughout the transcripts. Participant 6 identified the purpose of industrial education as a program to "teach students the workings of machines . . . anything that involves working with your hands." Participant 4 described industrial education as "teaching people how to use their hands" and Participant 1 described it as "more hands-on for kids to do something with their hands." Participant 10 was passionate about the hands-on component of the curriculum and exclaimed, "Darn it, we still have kids that . . . love to work with their hands! They love to build something. They love to build things. They are eager to get out and make money, and they can do that." As for a future curriculum, Participant 6 shared concern that "we don't stray too far away from some hands-on skills versus the technology side of things." When discussing labor needs, Participant 5 discussed the need for workers "who know how to use their hands and build things" and Participant 1 described how local companies "can't find enough workers that want to do stuff with their hands and work."

The root word *broad* or *explore* was used 29 times throughout the interview transcripts. Participant 3 identified the broad-based construct as providing the students with a strong technical foundation at the secondary level that could then be mastered in a specific area at the post-secondary level. Participant 7 described broad-based technical learning as teaching students "level 1" knowledge and skills and believed the more refined "level 2" and "level 3" skill sets were more appropriate for the post-secondary level. Participant 9 defined the industrial education curriculum as "exploratory skill building" and described the importance of teaching students a variety of technical experiences that could be transferrable to multiple future career fields. Participant 12 defined the industrial education curriculum as "preparing students with a wide-base knowledge that will give them a step ahead either when they go to a college, a vocational-technical school, or straight out to the working world." Components of the broad-based curriculum described by the participants included the (a) use of tools, (b) use of machines, (c) different materials, (d) safety, (e) use of technology, (f) problem-solving, and (e) design.

The root word *life* was used 19 times throughout the interview transcripts. The life-long learning construct was evident by the participants as they described how the industrial education programs helped students learn future life skills. For example, Participant 8 identified industrial education as a "life learning tool" and Participant 6 described it as developing a "sense of craftsmanship." Participant 8 reflected, ". . . just teaching them something they can use for the rest of their lives just really makes my life." In Participant 12's program the students were expected to demonstrate a strong work ethic and give 100% every day for the whole class. The Participant reflected, "I'd say the one thing that I give my students is pride in what they can do. I think that'll take them a long way in life."

Emergent Theory 3: Industry Demand-based Change

The study participants were most responsive to external change initiatives that were in alignment with changes made in industry, and constructs described by the participants included (a) industry-based technologies, (b) Kansas career pathways, and (c) computer numeric control (CNC) machine (see Table 6). All 13 participants' (100%) programs reflected similarities to traditional industrial education-based programs. For example, Participant 9 described the courses as "pretty traditional project-oriented classes that you would see in most industrial arts programs," and nine of the 13 participants (69%) described how their teaching and curriculum were heavily influenced by the manner of instruction they themselves had in high school or college.

Table 6: Constructs for Industry Demand-Based Change

Construct	Frequency	%
1. Industry-based technologies	9	69%
2. Kansa career pathways	10	77%
3. CNC machine	11	92%

NOTE: N = 13.

Although all of the programs had similarities to traditional industrial education, all 13 participants (100%) described the inclusion, or need for greater inclusion, of current industrial-based technologies within the programs. Nine of the 13 participants (69%) specifically identified making changes based on the current demands of industry. Participant 7 discussed the influence industry should have on the curriculum and stressed how the industrial education courses should "move along with industry" and Participant 5 emphasized, "Industry guides what I do in my classroom. I don't teach these kids something that they won't be able to step into and start running with. Getting [students] ready for industry is my biggest concern." The remaining four participants (31%) who did not specifically identify making changes based on the demands of industry, did however describe the influence of the state's career and technical education pathways initiative on their curriculum. For example, Participants 1 and 6 said, "The state funding pretty much dictates the courses anymore" and "Right now the biggest influence is the state, the funding, and the pathways." When changes did occur, participants reported they were most comfortable with incremental changes. Participant 9 described it as "an evolution at a snail's pace," and Participant 6 agreed and said, "We are slowly changing."

The most common current industrial technology identified by the participants was the inclusion, or the desire to include, a CNC machine. Participant 2 explained, "We incorporate a lot of CNC routing. From very simple stuff [like] inlays and 3D carvings to total projects from start to finish. That's kind of the biggest difference from what we did quite a while ago" as well as Participant 1 who said, "We incorporate a lot more CNC router work." Participants 3 and 9 did not have CNC machines but shared, "I would like to add a little bit more technology like a CNC with our woodworking" and "I would really like to bring in some CNC equipment . . . to add to the expertise of the kids coming out of here and being able to see how the CNC is used in industry." As for the need for more industrial technologies, Participant 7 stressed, "It's absurd that we don't have a CNC. It's absurd that we don't have more advanced technology."

Even though the name of the discipline as a whole had changed twice during the participants' tenure, the name change had little effect on their curriculum as Participant 5 emphasized, "It doesn't really matter what they call it . . . my common goal [is] for putting kids out there that can go to work," and Participant 7 said, "Personally, I don't see it as different. For whatever reason . . . the word industrial or career tech has created [an unacceptable] (connotation) and that my son or daughter is not going into those fields because maybe I'm a white-collar worker." Participant 9 described the changes as "name changes for the sake of trying to define who we are," while Participant 11 rationalized the name change as an "attempt from the state to bring up the quality of students in drafting."

DISCUSSION

The implications of this study may be significant for current practitioners and professional leaders in the technology and engineering education discipline. Though the current study was only conducted within the state of Kansas and the qualitative nature of the study limits the generalizability of the results outside of the study participants, the three emergent theories are significant because they provide evidence of the values and beliefs of the educators in the study and possible constructs for further research. The educators in the study perceived the original transition from industrial arts to technology education as inefficacious and did not see a clear difference in the more recent transition to engineering education. The implication of emergent theory 1 is it provided partial explanation as to why industrial education teachers have resisted the curricular transition to technology and engineering education (i.e., research question 2). Just as industrial educators resisted the initial transition from industrial arts to technology education (Kelley & Wicklein, 2009; Rogers, 1992), the emergent theory indicated educators would continue to resist the latter changes toward engineering design unless there is a clear demonstration on the efficacy of the curriculum and changes are made in alignment with emergent theories 2 and 3.

Emergent theory 2 clarified a distinction between the educational philosophies of technology and engineering education leaders and practitioners in the field in that the leaders of the discipline have built and promoted a curriculum through a theoretical lens based on a liberal education for all students, whereas industrial educators have adopted a more blended approach between general education and vocational education with an emphasis in technical learning. This differentiation provides a partial explanation for the discipline’s identity crisis documented over the past three decades (Akmal, Oaks, & Barker, 2002; Katsioloudis & Moye, 2012; Sanders, 1997) and insight into the cultural values of industrial education teachers.

Industrial educators made incremental changes in alignment with industry-based career and technical education initiatives. The implication of emergent theory 3 is that it identified the partial existence of the educational philosophy of vocationalism with industrial education teachers in Kansas. As part of the 21st century dialogue on college and career readiness through the transition from vocational education to career and technical education, the Kansas State Department of Education established multiple incentives for high schools to emphasize career readiness, including additional school funding and tuition-free postsecondary credits for students enrolled in career and technical education courses.

Another implication of emergent theory 3 for the technology and engineering education discipline was it identified a greater alignment among industrial education teachers with vocational-oriented programs through career and technical education and not with broad-based technology literacy programs through technology and engineering education. In aligning their programs with the current demands and needs of industry, industrial educators demonstrated they were not outright resistant to change, but instead demonstrated an ideological and cultural resistance to the technology and engineering education curriculum as inquired by research question 1. The educators did not perceive the recommended broad-based technology and engineering education curriculum as relevant to the industrial career paths of students and therefore resisted the transition and instead made changes associated with the career pathway initiatives that align with industry-based demands and statewide initiatives (Moye et al., 2012; Wright et al., 2008).

CONCLUSION

The three emergent theories may provide useful information for the leaders of technology and engineering education in addressing the division and identity crisis within the discipline (Akmal et al., 2002; Katsioloudis & Moye, 2012; Sanders, 1997). The evidence from the emergent theories indicates that the leaders of the technology and engineering discipline need to evaluate the current technology and engineering education curriculum and (a) differentiate it from the previously recommended modular technology units, (b) identify opportunities for technical learning, and (c) identify alignments between the learning activities and the demands of industry. This current study was only conducted within the state of Kansas and the qualitative nature of the study limits the generalizability of the results outside of the study participants. Therefore, future research is needed to operationalize the emergent theories, test the theories, and survey a larger geographic population to generalize the findings to a larger population of educators.

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