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Testing a Scale of Teacher Beliefs About Universal Curriculum Integration in the 21st Century (UCI21-T)

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ABSTRACT

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Curriculum integration is a unique approach to teaching. Twenty-first century skill approaches to curriculum integration train teachers in the process of curriculum integration, such that they are able to integrate various subject combinations in their teaching that produce new skills and dispositions in their students. Yet no scale to measure teachers' beliefs about the value of and efficacy beliefs towards implementing curriculum integration exists that is universal in the sense that it can be used any time any subject combination is integrated. Using a sample of 196 teachers at a professional development meeting in a mid-sized suburban school district in the Mountain West, this dissertation tests a scale that measures teachers' beliefs about the value of and efficacy beliefs towards curriculum integration and assesses its psychometric properties. The UCI21-T scale loaded as a bifactor model with one general factor and two specific factors. Conceptually and practically, however, the scale is best scored and reported as a two-correlated-factor model. The scale demonstrated evidence of validity and reliability and shows promise for use by administrators and professional developers when assessing teachers' beliefs about the value of and efficacy beliefs towards 21st century curriculum integration.

Keywords: curriculum integration, 21st century skills, elementary school, factor analysis

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CHAPTER 1

Introduction

Curriculum integration involves teaching two or more subjects simultaneously. It can be traced back to John Dewey's recommendation in the early 1900s, that teachers should integrate the teaching of various school subjects (Dewey, 1907). This idea continues to this day, although it has evolved over time and been given different names. Twenty-first century curriculum integration involves the use of an inquiry-based approach intended to promote deep learning through cross-disciplinary tasks to help students develop skills needed to compete in the 21st century (Scott, 2015). Professional development that trains teachers in curriculum integration exists alongside this effort. Once teachers have this knowledge, they can integrate subject combinations in their classroom teachings that may lead to their students acquiring new skills and dispositions.

Curriculum integration has both proponents and detractors. Those in favor of curriculum integration cite its strengths as being (a) time-efficient as it allows multiple subjects to be taught simultaneously; and (b) flexible, as units can last anywhere from two weeks to an entire school year (Jacobs, 1989). Detractors note that it can be intimidating and counterintuitive to some teachers, as it requires leaving behind traditional curriculum planning (Drake, 1993). There is also a question of whether or not curriculum integration, with its rewiring of curriculum, can survive in an era of high-stakes testing (Vars, 2001). However, proponents of curriculum integration argue that with extra effort, it is possible to align integrated instructional strategies and assessments, citing research showing alignment is a stronger predictor of student achievement on standardized tests than socio-economic status, gender, and race (Drake & Burns, 2004; Mitchell, 1998; Wishnick, 1989).

Due to the popularity of the curriculum integration movement and the lack of scales in this area, instruments designed to measure teachers' attitudes towards this innovative integrated approach to teaching are needed. *Beliefs* about the value of curriculum integration and *efficacy beliefs* towards curriculum integration were chosen as the psychological constructs this dissertation is measuring. Similar psychological constructs were assessed in the Beliefs Elementary Engineering – Teachers (BEE-T), a scale developed by researchers at Brigham Young University (Rich, Jones, Shumway, Miner, & Anderson, under review), to measure teacher *beliefs* about the value of teaching engineering concepts and principles at the elementary school level and teacher *efficacy beliefs* towards engineering at the elementary school level. The UCI21-T, or 21st Century Universal Curriculum Integration – Teacher scale, modifies engineering items from the BEE-T to make them relevant to curriculum integration.

A systematic review of the literature found in Chapter 2 of this dissertation concluded that teacher *beliefs* about and *efficacy beliefs* towards curriculum integration were common measures assessing teacher attitudes towards curriculum integration (knowledge and general attitudes towards integration, behavior, and perceptions of students were also found), validating the appropriateness of using these two constructs for the scale. The literature review also found the vast majority of existing scale-based outcome studies assessing teachers' attitudes towards the process of integrating curricula was limited. No current scale exists that measures teacher attitudes using this integrated approach that is broad enough to incorporate all the subject combinations curriculum integration makes possible that has been psychometrically tested. Nevertheless, work on integrating a plethora of different subjects to acquire new skills and dispositions continues (Burstein & Knotts, 2010; Russell-Bowie, 2009; Sizemore, 2010).

The field of education would benefit from a measure of teacher attitudes towards integrating curricula that is universal in the sense that it can be used to measure the effectiveness of any type of curriculum integration. Answering the question of the effectiveness of curriculum integration will be hampered if new scales have to be developed each time different subjects are integrated together. Questionnaire items are needed that can assess teachers' perceived efficacy in competently making connections between various content areas, skills, and dispositions. Teacher beliefs in the importance and appropriateness of this type of education also need to be measured. If teachers are not convinced of the value of curriculum integration throughout the course of professional development, it will not be implemented effectively. Teacher responses on the scale can then be compared before and after a professional development. Scale items are furthermore needed that assess teachers' confidence in their ability to complete each step involved in the process of curriculum integration. And if the scale is truly reflective of current curriculum integration, it also needs to include content on 21^{st} century skill acquisition.

Existing Professional Development Program

A curriculum integration professional development training is currently occurring in a mid-size suburban school district in the Mountain West. Seven schools agreed to participate in the program over several years. These conditions provide an ideal opportunity for a scale on teachers' beliefs about and efficacy beliefs towards curriculum integration to be tested. The sample size assures sufficient statistical power to conduct confirmatory factor analyses, and the multi-year project allows time for questionnaire items to be developed and refined.

This professional development initiative is intended to prepare practicing teachers from several elementary schools to create curriculum integration through cross-disciplinary deep learning tasks training teachers using the process created by Drake and Burns (2004). Drake and

Burns use what they describe as a ‘generic’ administration of curriculum integration. Like many other researchers, they started studying curriculum integration in the early 1990s, as part of the revitalization of curriculum integration that occurred in the 1980s and 1990s when curriculum integration, coined as “thematic” education, was popular. Curriculum integration is currently enjoying a new revitalization, riding the wave of popularity of the “21st century skill” movement. This new generation of curriculum integration encourages character, citizenship, collaboration, communication, creativity, and critical thinking. The Drake and Burns model that is used in the Alpine School District for their curriculum integration effort is situated in this context.

The ongoing effort began in 2016 when Alpine School District identified 16 schools to participate as a cohort group in receiving professional development training created towards this aim. Seven of the 16 schools were selected to participate in questionnaires as part of the professional development. This development typically occurs over four days in the summer in which K-6 teachers from these schools gather to receive instruction on integrated planning, instruction, and assessment. Teachers engage in unpacking knowledge, skills, and dispositions embedded in the Utah State Board of Education (USBE) core curriculum documents, and then are instructed in the principles and practices of integration. Teachers are given time as grade-level teams to plan and create integrated units and lessons for implementation in the upcoming school year. Throughout the week, teachers experience several deep learning tasks that featured integrated lessons. They are also encouraged to share examples through photographs, narratives, and videos of their integrated lessons with their students.

In addition to the four days of professional development in the summer of 2017 that occurred for the cohort used in this study, teachers participated in several additional integration days throughout the year (Fall 2017 and Winter 2018) in which they further experienced integrated lessons; observed colleagues teaching integrated lessons and worked together as cross-school collaborative teams to create integrated teaching opportunities. Throughout the summer training and school year implementation, teachers participated in several questionnaires aimed at measuring their beliefs about and efficacy beliefs towards integration as well as to identify needs, successes, and barriers of integration.

Existing Scale Modified into Integration Scale

The integration questionnaire administered at these professional development training sessions was modified from an existing scale created by a team of PhDs, which included professors and researchers from the Colleges of Education and Engineering at Brigham Young University and the Department of Counseling, Foundations, and Leadership at Columbus State University[1]. The original scale, called the BEE-T (Beliefs Elementary Engineering – Teachers), is a scale that has also been developed to measure the impact of a teacher professional development in engineering and is already in use in Alpine School District. The reason the BEE-T was created was to measure the growth of teacher beliefs and self-efficacy beliefs towards teaching elementary engineering and hence assess the effectiveness of the professional development.

In the recent paper by Rich et al. (under review) entitled "Measuring Elementary Teachers' Beliefs about Engineering," two psychological constructs relevant to teachers' and their attitudes towards curriculum integration are present. The BEE-T instrument refers to (a) *beliefs* as the deeply-held opinions about a subject, such as its value (Fang, 1996) and suggests

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[1] The team consists of Dr. Peter Rich, Instructional Psychology and Technology, Brigham Young University; Dr. Eli Jones, Counseling, Foundations, and Leadership, Columbus State University; Dr. Steven Shumway, Engineering, Brigham Young University; Dr. Amy Miner, former Research Professor in Education at Brigham Young University and now Curriculum Manager at Alpine School District; and Nicole Anderson, Educational Inquiry, Measurement, and Evaluation Ph.D. student, Brigham Young University.

teachers' beliefs influence how they approach a subject and communicate its value to students. Additionally, the framework of (b) *efficacy beliefs* stems from the work of Bandura (2010) and Tschannen-Moran, Hoy, and Hoy (1998), who suggested that efficacy beliefs are the self-perceptions of competence rather than actual levels of competence. Perceived efficacy beliefs are different from other concepts such as self-esteem and locus of control (Bandura, 2006). While self-esteem is a judgment of self-worth, an efficacy belief is a judgment of capability. Locus of control is a belief whether or not outcomes are determined by one's actions rather than forces outside of one's control. Furthermore, efficacy beliefs are domain-specific. A person may have different beliefs or perceptions of their efficacy towards one domain compared to another. A teacher's sense of efficacy is important as it influences how a teacher will communicate the importance of a subject domain to their students. Furthermore, multi-faceted efficacy belief scales are needed that account for different perceived efficacy beliefs operating within a domain. Implementing engineering at the elementary school level may involve different efficacy beliefs, such as the self-belief that a teacher has both the requisite science and math skills in order to implement engineering at the elementary school level (similarly, a curriculum integration item assesses a domain of teaching that may involve different efficacy beliefs, such as unpacking core standards for content, skills, and dispositions such that they can be reorganized objectives suitable for curriculum integrated teaching). Each needs to be accounted for in item creation for assessing efficacy beliefs of teachers in the teaching elementary engineering domain.

The BEE-T has demonstrated evidence of validity and reliability when subjected to both an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), with the results of the CFA indicating a good model fit. Based on the BEE-T instrument, a new instrument was created in which the original BEE-T items were retained, with engineering words and phrases being substituted with words relevant to curriculum integration. Additionally, items pertinent to the process of integration written by local integration experts were added that were not based on existing BEE-T items.

In the new instrument, the construct of teachers' beliefs towards curriculum integration describes the value that teachers place on curriculum integration as a viable teaching method. If teachers do not believe that education administered in this manner is important and valuable, this has implications for the utility of training teachers in how to administer integrated education at all. The construct of teacher beliefs about curriculum integration assesses ***why*** curriculum integration should be used as a teaching method. Conversely, the construct of teachers' efficacy beliefs towards curriculum integration assesses the ***how*** of curriculum integration. This is done mainly through items written by curriculum integration experts assessing teacher efficacy for each of the different steps necessary to administer curriculum integration, or items assessing teachers' *process* efficacy beliefs towards curriculum integration. Other efficacy belief items studied in this dissertation, assessing *general* efficacy beliefs towards curriculum integration, also constitute the ***how***. They provide a measure of general confidence towards administering curriculum integration.

The UCI21-T, or "21st Century Universal Curriculum Integration Scale – Teacher," modified from the BEE-T with items added from local integration experts, constitutes the item of study for this dissertation. This new integration questionnaire was created to measure the impact of a local curriculum integration professional development on teacher beliefs about and efficacy beliefs towards implementing curriculum integration. Various items have been included in the questionnaire over the past few years while this project in curriculum integration has been in operation, with the UCI21-T constituting the latest thinking in developing appropriate measures. The UCI21-T is based on the strong foundation of the BEE-T scale, with demonstrated evidence of its validity and reliability being found after undergoing various item modifications and extensive psychometric testing.

Purpose and Rationale

The first purpose of the proposed study was to assess the psychometric properties of a new scale entitled the 21st Century Universal Curriculum Integration – Teacher's Efficacy and Beliefs Scale (UCI21-T). This scale is designed to assess teachers' (a) beliefs in the value and viability of integrating curricula at the elementary school level; and (b) their efficacy beliefs towards integrating curricula at the elementary school level, including items both on general efficacy beliefs towards curriculum integration as well as process efficacy beliefs towards curriculum integration. The assumption that these two efficacy belief subconstructs will load onto one efficacy factor, as there is no theoretical evidence at the outset indicating any reason why they should load separately. This scale breaks new ground in providing a measurement instrument for the burgeoning field of curricula integration at the elementary school level. The different subject combinations that are being integrated in elementary school teaching continue to multiply in diverse ways; yet, no scale to assess teachers' efficacy beliefs about the value of and beliefs towards this kind of teaching that can encompass any kind of subject combinations as of yet exists.

Research Questions

1. What evidence is there to support the hypothesized two-factor structure (*beliefs* about and *efficacy beliefs* towards teaching curriculum integration at the elementary school level)?

a. How many factors should be retained?

b. Which items load on each factor?

c. Which items, if any, do not load on either factor and should be deleted?

d. Which items, if any, load on more than one factor and should be deleted?

e. To what extent are the resulting factors correlated?

2. What is the estimated reliability of each scale?

a. To what extent do the items on each scale have correlated error variances?

CHAPTER 2

Review of Literature

A systematic review of the literature was conducted to (a) generally define curriculum integration and put the current study into context, (b) verify that insufficient measurement instruments currently exist to study teachers' beliefs about the value of and efficacy beliefs towards the value of curriculum integration, and (c) assess the possible impact of a new scale by discovering all the various subject combinations, skills, and dispositions that have been connected with curriculum integration. It was comprised of research from three different sources: (a) A systematic review of the literature using keywords, (b) one of the local integration experts conducting professional developments on curriculum integration, and (c) an informal Internet search.

Method

The systematic review of the literature was conducted by searching in ERIC (Educational Resources Information Center), the premier education database. The keyword search using Boolean "AND" and "OR" statements included integration (*integrated activities*, *integrated curriculum*, *integrated learning systems*, *interdisciplinary approach)*; elementary school (*elementary education*, *elementary school curriculum*, *elementary school students*, *elementary school teachers*, *elementary schools)*; beliefs (*beliefs)*; and efficacy beliefs (*confidence* and *self-efficacy).* There were 175 documents identified using the search terms, which constituted studies being developed in the time frame of 1968 to 2018. The other terms synonymous with curriculum integration, including *interdisciplinary teaching intra-disciplinary teaching*, and *thematic teaching* were each substituted for the integration search terms and combined with the other search terms; however, these terms did not yield additional results, other than a plethora of hits (approximately 23,000) found using Smart Text searching of keywords, where any of the words showing up in a record would be tagged.

Perusing the studies by viewing at least the title and abstract, it was found that some exclusion criteria needed to be applied. Some hits pertained to cultural curriculum integration, or making education appropriate for different ethnic groups; others involved research on integrated education other than curriculum integration (e.g., integrating content and methods in teacher training); these studies were excluded from the literature review. Other hits included studies on curriculum integration that, despite being found using the elementary school search terms, were pertinent to middle school, high school, and higher education. These were deleted unless they were also relevant to elementary school, in which case they were retained. Additionally, studies assessing student outcomes instead of teacher outcomes and a few others were deleted if they did not contribute to the purposes of the literature review described at the beginning of this chapter.

Results

Eighty-two studies from the key-word search were retained for the final analysis after all the exclusions were made. Additionally, twelve sources identified by an integration expert were analyzed, as well as information gathered from six sources found through informal searches on the internet. Information was obtained on the definition, historical background, theory, and implementation process of 21st century curriculum integration; in addition, studies detailing the various combinations of subjects, skills, and dispositions were gathered.

Background and history of curriculum integration. John Dewey, the father of education, describes the idea of curriculum integration in the early 1900s:

> All studies grow out of relations in the one great common world. When the child lives in varied but concrete and active relationship to this common world, his studies are naturally

> unified. It will no longer be a problem to correlate studies. The teacher will not have to resort to all sorts of devices to weave a little arithmetic into the history lesson, and the like. *Relate the school to life, and all studies are of necessity correlated.* (Dewey, 1907, p. 107, emphasis added)

The National Council of Teachers of English (NCTE) provided the following definitions in 1935:

> Correlation may be as slight as casual attention to materials in other subject areas … a bit more intense when teachers plan it to make the material from one subject interpret the problems or topics of another…Integration is the unification of all subjects and experiences (in Nargund-Joshi & Liu, 2013, p. 4).

Drake and Burns (2004) summarized the history of curriculum integration in the first half of the 20th century:

> Curriculum integration began in the late 1800s with the Herbartians, a movement named after German philosopher and educator Johann Friedrich Herbart. Herbart developed the idea of correlating disconnected subject areas around themes, sometimes referred to as "integration of studies" (Klein, 2002). In the 1920s, John Dewey led the Progressive movement; progressive education placed students' personal and social concerns at the center of curriculum. The term "integrated curriculum" also described the project approach in the 1920s, the core curriculum movement in the 1930s, and the problem-centered core curricula of the 1940s and 1950s. In fact, core curriculum and team teaching have been components of middle schools since their inception around the turn of the century. (Drake & Burns, 2004, p. 27)

Thematic teaching was a popular term for curriculum integration in the 1980s and 1990s. Related terms include *interdisciplinary teaching*, and *intra-disciplinary teaching, fusion education,* and *connected education*. All these concepts involve essentially the same definition: organizing a teaching curriculum around a central theme, or unit. There is a difference between inter-disciplinary and intra-disciplinary instruction, however. *Inter*disciplinary teaching involves integrating across multiple disciplines, such as integrating mathematics (science) and music (the arts); whereas *intra*-disciplinary teaching involves integrating multiple subjects within a discipline, such as integrating within the arts (e.g., music and visual arts) or within the sciences (e.g., technology and engineering).

In a detailed review by Hartzler (2000), curriculum integration is described as being broader than just integrating subjects around a theme, it also involves students making connections between not just subjects, but also skills and dispositions. After summarizing the history and existing research on curriculum integration, she provides a definition of curriculum integration:

> . . . integrated education is a form of horizontal organization that seeks to break down the walls of traditional academic disciplines by providing learning experiences that explicitly link content, skills, and/or values of two or more of the traditional academic disciplines. Integration can only be achieved through instruction that explicitly promotes and guides students in making important connections, whether the connections are between subject areas, skills, or values…Ultimately, integration must take place in the minds of the learners. This definition provides a framework for designing integrated curricular programs that allows for varying degrees of integration and different methods of integration. (Hartzler, 2000, p. 175)

Twenty-First century curriculum integration. The current revitalization of curriculum integration in education occurs along with the trend towards 21st century skills. Character can be seen as a 21st century value or disposition, whereas citizenship, collaboration, communication, creativity, and critical thinking can be seen as both 21st century values/ dispositions and skills. Twenty-first century curriculum integration has also started to involve more integration of technology in classrooms. Twenty-first century skill curriculum integration of the type this dissertation will be focusing on involves several innovative educational approaches, including deep learning approaches, 21st century skill acquisition, and inquiry-based learning.

According to Luna Scott (2015), technological innovations are a driver that necessitates the development of new skills in this 21st century so that students can keep up with these innovations. These technological innovations also facilitate learning that would not be possible otherwise. Mobile devices and social media make learning possible anytime and anywhere and allow classrooms to transcend borders and combine resources with others across the globe. Twenty-first century skills do not have to all be based in technology; however, technology has created a new, more interconnected world that students must be able to navigate in order to succeed regardless of their eventual career paths and choices.

Fullan, Quinn, and McEachen (2018) cite six global competencies associated with 21st century skills: (a) character, (b) citizenship, (c) collaboration, (d) communication, (e) creativity, and (f) critical thinking. These are an extension of the P21: Partnership for 21st Century Skills (2016) four core 21st century skills of (a) collaboration, (b) communication, (c) creativity, and (d) critical thinking. *Collaboration* is defined as demonstrated ability to work effectively and respectfully with different people; it involves making compromises (P21: Partnership for 21st

Century Skills, 2016). *Communication* involves articulating thoughts clearly, listening effectively, and using communication for a variety of purposes. *Critical thinking* involves reasoning effectively, synthesizing information to make appropriate judgments, and using innovative thinking to solve problems. *Creativity* involves effectively brainstorming new ideas, refining and improving them, being open to a diversity of perspectives, along with an understanding of the real-world limits of implementing new ideas. Fullan and colleagues also provide definitions for character and citizenship. *Character* involves persistence, resilience, responsibility and integrity in learning; while *citizenship* involves thinking like global citizens, embracing diversity, demonstrating competence in solving complex real-world problems, and showing empathy and concern for others.

In defining the conditions that make deep learning, 21st century skill acquisition, and curriculum integration necessary, Fullan et al. (2018) state: "If we want learners who can thrive in turbulent, complex times, apply thinking to new situations, and change the world, we must re-imagine learning" (p. 13). Pressing world problems that need to be solved often involve no one right answer, and deep learning that occurs while students are engaged in learning about multiple subjects simultaneously can help them to develop this critical mindset of problem-solving.

Deep learning can involve more effort than traditional types of teaching at the elementary school level. Traditional approaches to learning, such as lecture, memorization, and application of simple procedures, do not go far enough to help students develop critical thinking skills that are going to be needed to survive in the 21st century (Luna Scott, 2015). An alternative to these traditional educational approaches is found in inquiry-based education (Ford, Fifield, Madsen, & Qian, 2012). As opposed to traditional teaching formats that are largely teacher centered, inquiry-based education is to various degrees a more student-centered approach, depending on which integration model is followed (Drake & Burns, 2004). It can also be collaborative, as students can be put into teams to solve problems, which inquiry-based approaches encourage.

Examples of curriculum integration. There are many examples of curriculum integration that can be found in the literature and in teacher practice. As one example, integrated learning could consist of an interdisciplinary unit on rivers. The local river system would be the unifying theme, it would consist of language arts by studying river vocabulary and teaching students how to do a research report; it would consist of science by teaching about the life systems that exist in the river; it would consist of social studies by having students research the local history and peoples who used the river for transport and food (Cohen, 2014).

Examples of 21st century curriculum integration are similar to the theme-based instruction example just described. However, with more of a focus on 21st century skills in the current wave of curriculum integration, teaching is changing in subtle and not-so-subtle ways. Kindergarten students may work in a group to create a giant mural, with students being designated to different tasks, asking one child to do a rough drawing, one child making the final decision in case of a conflict, etc., helping students learn how to communicate and resolve conflicts. Teachers are beginning to teach math skills in more collaborative environments in the context of problem-solving with less of a focus on computation and more of a focus on reasoning with data. With students building skills in analyzing and critical thinking, they will be able to focus on whatever interests them, with less of a specialized subject emphasis on science, social studies, and geography (Ben-Jacob, Levin, & Ben-Jacob, 2000).

A real-world example of 21st century curriculum integration is found in the Alpine School District, where the current study was conducted. This example involved studying maglev trains, where elementary school students were able to learn about science, technology, engineering, and civics simultaneously. As one 5th grade teacher explained:

> We were talking about air quality issues in class, and transportation issues along the Wasatch front and how magnetism could actually help benefit some of those as they create a maglev train. Those are high speed trains that use magnetic force for movement instead of an engine driven by fossil fuels or electricity. So they travel much faster. We were investigating all of this stuff about magnets, and then they build a maglev train tracks and do experiments with that. That's something that Dr. Shumway helped with . . . his vision helped make that more applicable to our world here along the Wasatch front. Because he took it and he tied it into things like, not just air quality, but speed and the traffic issues we have along the Wasatch front. So then my class took it and then we did surveys and had polls and made graphs about what do people want and why do they choose one way or another in terms of how they travel up to Salt Lake and back. We compared other demographics of places in our country that have similar pollution issues and why they have that. So we are tying geography in with it. And we looked at places around the world that use the maglev system and how effective they are. And then we wrote a proposal to the state legislators and the governor. When we went up to Education on the Hill Day and they had their tracks and were problem solving up there so that the legislators could kind of see "this is what's going on." So I had them work on these trains speeds, how we could get it down, frictionless travel and stuff like that, while the legislators were watching them. But we also had this letter that the class wrote, a persuasive essay, which persuasive essays are one of the 5th-grade writing standards that we are supposed to teach them. So we could tie this all in as well as create civic

mindedness in the children, because we were studying government at the time (J. Seebok, personal interview, March 17, 2017).

Process of curriculum integration. This dissertation focuses on the 21st century curriculum integration just described. Drake and Burns (2004) and Fullan et al. (2018) discuss the practical aspects of ***how*** teachers should implement this education. They have written extensively about the process of integration. They describe the "know, be, do bridge." This involves incorporating the three basic elements of curriculum integration: integrating content (*knowing*), integrating skills (*doing*) and integrating values (*becoming*). *Knowing* involves the acquisition of facts and understanding of concepts and principles. It is the easiest to measure using standardized tests. *Doing* involves becoming proficient in skills such as critical thinking, research, communication, and analysis. *Becoming* involves developing values or dispositions. Becoming involves what may be the most controversial of the three to be taught in schools.

With this top-level view of curriculum integration in mind, teachers must be proficient in a series of steps to successfully implement curriculum integrated teaching in their classrooms. These steps involve unpacking state education standards, writing lesson objectives for integrated lessons, maintaining the integrity of each content area, and assessing student learning of curriculum integrated lessons. Together, they constitute a process that teachers must go through to shift from more traditional teaching to this method of curriculum integrated instruction.

Unpacking the standards. The first step in the process of integration involves decoding the performance requirements encoded within the state standards. All the pieces of the learning need to connect to the actual learning experience. Teachers need to interpret and analyze each standard. Each standard should be checked for knowledge, skills, and dispositions. The combining of *knowing* (content areas), *doing* (skills), and *being* (dispositions) can then be done in a plethora of combinations, with teachers knowing exactly which of the state core standards their newly constructed integrated lessons are addressing.

As an example, Drake and Burns (2004) cites an Ontario Curriculum writing standard at the 6th grade level of "Communicate idea and information for a variety of purposes (to inform, to persuade, to explain) and to specific audiences (e.g., write the instructions for building an electrical circuit for an audience unfamiliar with the technical terminology"). The *know* in this case refers to writing conventions (grammar, punctuation, spelling, visual presentation, and word use) and writing styles (persuasive, explanatory, and informative)", the *do* is to "communicate effectively by applying writing conventions" and the *be* are "values that are embedded in communications and in persuasive writing" (p.56). As Drake and Burns note, state standards may include one, two or three of the tri-bridge of content areas, skills, and dispositions.

Writing lesson objectives for integrated lessons. Teachers also need to be able to write lesson objectives for integrated lessons. What content areas, skills, and dispositions are the integrated lesson targeting? Again, this may be somewhat counter-intuitive, as this may involve separating standards out and putting them back together to tie them specifically to aspects of their integrated lessons.

Maintaining the integrity of each content area. Successful curriculum integration also needs to balance each of the subject areas that is being integrated, such that none are neglected. Each subject's indicators and outcomes remain discrete and authentic, and the integrity of each subject is maintained (Russell-Bowie, 2009). Maintaining the integrity of subjects appears to be more of a problem in the arts than the sciences. Roucher and Lovano-Kerr (2010) note that teacher may see the arts as enhancements for whatever subject with which they are being integrated. For example, singing a song about the water cycle accomplishes objectives in teaching students about science but doesn't really teach students anything about music. To obtain proper depth of study, more than just singing a song would need to occur in terms of music instruction, notes, rhythm, etc.

Measuring student learning in integrated lessons. Finally, teachers must construct an assessment to measure learning upon completion of an integrated lesson. Drake and Burns (2004) note that rubrics can be created to measure student learning. For each skill, the teacher can create informal scales on which they can rate students. For example, for the skill of "summarizes idea," a rubric could involve response categories of "summarizes with a few details," "summarizes with some details," "summarizes well with detail," and "summarizes well with many relevant details" (p. 71).

Drake and Burns (2004) also describe a more in-depth assessment on an integrated lesson for which Medieval Times is the theme. The content areas are language arts, social studies, science and the arts; the skills are problem-solving, design and construction, research, presentation, and interpersonal skills; and the dispositions are being cooperative, responsible, and respectful. The assessment would involve constructing a booth at a school fair where students must (a) do an oral presentation on medieval times, (b) construct a story board with important facts they learned, and (c) be able to answer questions about what they learned. Additionally, they would have to select artifacts to include in an archive such as a castle with blueprints, stained glass windows, and maps. They would also write and perform a mystery play. These assessments would measure the presence of skills such as oral presentation, design and construction, and research. These skills would be tied back to the state core standards from which they were extracted. When done in this manner, curriculum integrated teaching can survive in the current era of high-stakes testing, as students are taught core standards, but in a more holistic and integrated way.

A Review of Studies on Curriculum Integration

Having discussed what curriculum integration (a) is, (b) its history, and (c) the process teachers must follow in order to implement it in their classrooms, we next turn to the many studies that met the inclusion criteria in order to compare the new scale to previous research. This is done in order to (a) verify that insufficient measurement instruments currently exist to study teachers' beliefs about and efficacy beliefs towards the value of curriculum integration, and (b) assess the possible impact of a new scale by discovering all the various subject combinations, skills, and dispositions that have been connected with curriculum integration.

Content areas integrated. Many studies involved combining one content area with other content areas and was often left broad and open to experimentation. Various forms of technology were integrated with content areas (see Al-Otaibi, 2017, Kinzie & Delcourt, 1991; Peck & Hughes, 1994; Sang, Valcke, van Braak, & Tondeur, 2009). Other studies described integration of the arts. These included visual arts (La Porte, 2015; Ross & Berk, 1989); dance, or "movement integration" (Webster, Erwin, & Parks, 2013); music (Baldwin & Beauchamp, 2014; Battersby & Cave, 2014; Russell-Bowie, 2009); and theatre (Kerekes & King, 2010; Kim, 2017; McCammon & Betts, 1999; Saraniero, Goldberg, & Hall, 2014). There was one study that integrated visual art, music, dance, and theatre (Davies, 2009). Various science subjects have been integrated with other content areas. The science areas included physics (Wenner & Simmonds, 2017), engineering (Berry, 2017; Grusenmeyer, 2017), earth and space science (Cervato & Kerton, 2017); and environmental education (Schumacher, Fuhrman, & Duncan, 2012; Sia, 1992; Sondergeld, Mulner, & Rop, 2014). Social studies was also found to be integrated with various other subjects (Holloway & Chiodo, 2009).

Some research assessed integrating a few specific content areas together, instead of assessing one subject integrated with other subjects broadly. These included reading and writing (Hains, 1982; Hopkin et al., 1997); reading and math (Wilburne & Napoli, 2008); reading and visual arts (O'Brien, 1982); reading and science (Bristor, 1994; Goldschmidt & Jung, 2011); reading and social studies (Franklin & Roach, 1992; Zagora, 2011); reading and health (Deal, Jenkins, Deal, & Byra (2009); language arts and science (Dickinson, 1996; Zwick & Miller, 1996); language arts and social studies (Rice, 2008); writing and math (Wilcox & Monroe, 2011); history and science (Hacieminoglu, 2014); music and math (An, Tillman, & Paez, 2015; Ladipo, 2013); music and science (Adams, Pedersen, & Narboni, 2014); health and math (van Laren, 2007); science and social studies (Ford et al., 2012; Snyder, Lewin, & Lippincott, 1996); visual arts and social studies (Burstein & Knotts, 2010; Sizemore, 2010; Zagora, 2011); visual art, reading, and drama (Saunders, 1983); math, reading, science, and social studies (Reed, 2002); and math, reading, writing, and science (Button, Fortino, Gerretson, & Johnson, 2006). All these studies demonstrate how prevalent curriculum integration has become in the field of education and how many different subject combinations can successfully be integrated.

Skills integrated. Several studies mentioned skills; including skills in art, (Davies, 2009; La Porte, 2015); language arts, e.g., reading (Bristor, 1994; Goldschmidt & Jung, 2011); mathematics, e.g., reasoning (An, Tillman, Boren, & Wang, 2014; Bers, 2010; Goodson-Espy et al., 2014; Lee & Ginsburg, 2009); music, e.g., perceptual, presentation, and performance (Adams et al., 2014; An et al., 2014); people, e.g., conflict resolution, communication, cooperation, participation (Wilburne & Napoli, 2008; Wilson, 2012; Yoder, 1992); science, e.g., literacy, process, questioning, writing, environmental literacy (Donovan & Haeusler, 2015; Goldschmidt & Jung, 2011; Lawless & Brown, 2015; Sondergeld et al., 2014); STEM (Horton, Krieger, & Halasa, 2013); self-directed learning (Reed & Westerburg, 2003); and thinking, e.g., problem-solving, critical thinking, computational thinking (Donovan & Haeusler, 2015; La Porte, 2015; Sondergeld et al., 2014; Wilburne & Napoli, 2008). Unlike what was found for content, where all content areas involved a combination of two or more subjects, these studies included cases where skills in just one content area were mentioned as well as skills that crossed disciplines. Examples of skills crossing multiple disciplines include Goldschmidt and Jung (2011) who focused on reading and science literacy, while Sondergeld et al. (2014) focused on literacy and critical thinking.

Dispositions integrated. Some studies focused on general dispositions towards teaching and learning (Bills, Mason, Watson, Zaslavsky, & Goldenberg, 2006; Burnett, Daniels, Gray, Myers, & Sharpe, 2015; Dever, Whitaker, & Byrnes, 2001; Haygood, Baker, Hogg, & Bullock, 2004; Ladipo, 2013; Snyder et al., 1996; van Laren, 2007). Other studies included dispositions towards different subjects, including art (Davies, 2009), mathematics (An et al., 2015; Watson, Beswick, Brown, & Callingham, 2007); science (Button et al., 2006; Freeman & Smith, 1997; Lewis, Harshbarger, & Dema, 2014; Zeegers & McKinnon, 2012); social studies/ history (Bintz & Dillard, 2007; Brady & Brady, 1971; Jones & Thomas, 2006); and sports (The President's Council on Physical Fitness and Sport, 1997). One study focused on dispositions towards 21st century skills (Doyle, Hofstetter, Kendig, & Strick, 2014). The studies on dispositions generally studied teaching and learning or only one disposition per study, although potentially, future studies may assess dispositions towards teaching more than one content area simultaneously (e.g., music and math) as curriculum integration gains more traction.

Scale-based measures used. As this dissertation assesses the psychometric properties of a scale, any scale-based studies found were examined in more detail (see Table 1) to compare the kinds of items and constructs that previous curriculum integration research has used to create the items for this study.

Most of the scales found assessed teacher *knowledge*, *beliefs*, *efficacy beliefs*, or other attitudes, with the most common scales and items measuring some domain of *efficacy beliefs* (see Table 1). Measures of teacher efficacy beliefs (n = 7), confidence (n = 6), and knowledge (n = 6) were most abundant, followed by measures of beliefs (n = 6), attitudes (n = 6), behavior (n = 3), perceptions of students (n = 3), awareness of subject standards (n = 2), and skills (n = 1).

Many different subjects were combined in the scale-based studies. Subjects included reading (n = 2), math (n = 2), engineering (n = 2), science (n = 4), the arts (n = 4), health (n = 1), and computer/technology (n = 1). Fifteen of the 22 measurement instruments studying two or more content areas being integrated pertained to only one subject domain. For example, one study on combining science and social studies only measured teacher efficacy beliefs towards teaching science (Ford et al., 2012).

Of the 22 scale-based studies found, only two studies, Etheridge (1973) and Godt, Benelli, and Kline (2000), measured curriculum integration generally. Both studies contained teacher inventories rather than scales (Etheridge's study used an inventory of items on student career development using an interdisciplinary approach, while the Godt et al. study selected items from an existing beliefs inventory that included items on curriculum integration). There were no psychometric analyses conducted to look for evidence of validity and reliability in either study.

Table 1

Description of Existing Curriculum Integration Scales

Study	Subjects integrated	Number of items, scales/subscales	Scale/subscale
Al-Otaibi (2017)	Technology + Other Subjects	1 scale, 6 subconstructs 52 total items	Study Skills:
			Setting-up goals and future planning
			Self-motivation
			Effective time management
			Memorization and taking notes
			Reading courses
			Readiness for exams
		1 scale, 52 items	Self-confidence:
			No subconstructs listed
		1 scale, 2 constructs	Academic achievement test:
		11 items	Lower order thinking
		12 items	Higher order thinking
An et al. (2015)	Music + Math	4 subscales, 30 items	Self-efficacy towards teaching mathematics:
			Efficacy teaching math, interdisciplinary pedagogy
			Efficacy motivating students to participate math tasks
			Efficacy math teaching via music contextualized pedagogy
			Efficacy providing positive math classroom environment
Baldwin and Beauchamp	Music + Other	2 scales, 5 items	Confidence teaching music
			Children’s performance/composition/appraisement levels

(table continued)

Table 1 continued

Study	Subjects integrated	Number of items, scales/subscales	Scale/subscale
Berry (2017)	Engineering + Other Subjects	1 scale, 4 items	Teachers' Engineering Knowledge (TEK) Survey: Understanding of the engineering design process Engineering concepts Engineering habits of mind Connections between engineering and other content areas
		1 scale 8 subconstructs 59 total items	Engineering Curriculum Design Self-Efficacy (ECD) Survey: K-12 engineering content Industry engineering content Engineering design process Project-based learning Student learning Integrated learning Teaching coherence Curriculum planning
Button et al. (2006)	Math + Reading + Writing + Science	1 scale, 10 items	Perceived proficiency in pedagogical knowledge and skills
Cervato and Kerton (2017)	Earth + Space Science	1 scale 2 subscales 23 total items	STEBI-B (Science Teaching Efficacy Belief Instrument – Preservice Teacher Version): PTSE (Personal Science Teaching Efficacy) STOE (Science Teaching Outcome Expectancy)

(table continued)

Table 1 continued

Study	Subjects integrated	Number of items, scales/subscales	Scale/subscale
Davies (2009)	Art + Other Subjects	6 scales, 17 items	Confidence in participation in the arts Appreciation of the value of arts education Understanding of relationship, arts/creativity/cultural ed Abilities to take on different roles in a network of adults Attitudes, multi-disciplinary approach across art forms Confidence in teaching the arts
Deal et al. (2009)	Health + Reading	5 scales, 36 items	Confidence about state health education standards Confidence about state language arts standards Use of literacy instructional strategies Status of health education in teacher classrooms Use of integrated instruction and training needs
Doyle et al. (2014)	Art + Other Subjects	5 scales, 30 items	Confidence in arts integration Propensity to conduct arts integration in future Teacher comprehension of national arts standards Implementation of arts in classroom Arts vocabulary knowledge
Etheridge (1973)	Interdisciplinary Approach	1 scale, 85 items	Attitudinal inventory
Ford et al. (2012)	Science + Social Studies	2 subscales	STEBI-B (Science Teaching Efficacy Belief Instrument – Preservice Teacher Version): PTSE (Personal Science Teaching Efficacy) STOE (Science Teaching Outcome Expectancy)
Goldschmidt and Jung (2011)	Reading + Science	2 items	Teacher attitudes towards science Teacher self-efficacy towards teaching science
Godt et al. (2000)	General Integration	13 of 57 items	Teacher belief inventory selected items

(table continued)

Table 1 continued

Study	Subjects integrated	Number of items, scales/subscales	Scale/subscale
Grusenmeyer (2017)	Engineering + Other Subjects	37 items	Design, Engineering, and Technology Survey (DET): Beliefs about engineering profession Beliefs about elementary engineering education
Hudson, Nykrist, and Mukherjee (2016)	Science + Other Subjects	6 items	Importance of teaching science Learning in teaching science Enthusiasm in teaching science Knowledge in teaching science Attitude in teaching science
Kinzie and Delcourt (1991)	Technology + Other Subjects	19 items, 25 items items not listed	Attitudes towards technology (ACT) Comfort/ anxiety towards computers (SCT)
Reed (2002)	Language Arts + Math + Social Studies + Science	8 items	Teacher confidence Perceptions, elementary student success w/4 teachers
Sang et al. (2009)	Technology + Other Subjects	5 scales, 14 items 8 Items 8 items 10 items 7 items	Teacher self-efficacy scale Teacher computer efficacy scale Attitudes toward computers in education scale Computer use scale Constructivist belief scale
Saraniero et al. (2014)	Arts + Other Subjects	2 scales, item numbers not listed	Teacher knowledge arts instruction, standards, integration Teacher confidence arts instruction, standards, integration Impact of arts intervention on teacher practice
Sia (1992)	Environmental Education + Other	1 scale 3 subscales	Efficacy towards teaching environmental education scale Belief efficacy in teacing environmental education Self-efficacy in teaching environmental education Outcome efficacy in teaching environmental education

(table continued)

Table 1 continued

Study	Subjects integrated	Number of items, scales/subscales	Scale/subscale
Sondergeld et al. (2014)	Science + Math + Technology	1 scale 6 subconstructs 8 total items	OBOR (Ohio Board of Regents) Survey: Teacher knowledge Teacher beliefs Attitudes toward environmental education Perception of student motivation in classroom activities Improvement of quality of student work
Webster et al. (2013)	Movement Integration (Dance) + Other Subjects	1 scale 2 subscales 16 items	Strength of beliefs movement integration scale Individual beliefs in movement integration Work group beliefs in movement integration

Conclusions

Three conclusions are apparent from this literature review. First, the lack of scale-based measures on universal integration, or curriculum integration regardless of what is being integrated, is quite evident. The literature review reveals there is a rich abundance of content areas (n = 52), skills (n = 23), and dispositions (n = 19) being combined in curriculum integration studies; however, 78 of the 100 studies comprising the literature review did not provide *any* scale measurement. Second, the scale-based studies that were identified provide evidence of the appropriateness of using efficacy beliefs towards the value of curriculum integration and beliefs about curriculum integration as measures for the curriculum integration scale being studied in this dissertation, as many of these studies collected measures of efficacy beliefs towards and beliefs about the value of curriculum integration. Third, the literature review found that only two of the 22 scale-based studies measured curriculum integration generally. Early research by Etheridge (1973) contained a few items on interdisciplinary education as part of a larger teacher inventory, while a study by Godt et al. (2000) studied some items on beliefs towards general curriculum integration from an existing teacher inventory. Neither study contained any psychometric testing of the items in their inventories; therefore a study of the validity of combining their items into scales has not been undertaken. The current study does undertake a psychometric analysis of items on general curriculum integration. Taken as a whole, this literature review indicates that the current study scale appropriately measures teachers' beliefs about and efficacy beliefs towards curriculum integration and that there is a need for the scale tested in this dissertation.

CHAPTER 3

Method

Participants

Approximately 225 teachers participated in professional development on integrated teaching during the 2017-2018 school year in Alpine School District, located in Utah County, Utah. Of those, 196 teachers filled out the questionnaire containing the UCI21-T items, thereby participating in this study. At that time, this district consisted of 64 elementary schools and served 78,000 families. The teachers attending this professional development meeting represented seven elementary schools in the district: (a) Dry Creek, (b) Lindon, (c) River Rock, (d) Rocky Mountain, (e) Saratoga Springs, (f) Sage Hills, and (g) Thunder Ridge. In terms of demographics, the teachers were predominantly female (87%). They were mostly grade-level classroom teachers (79%), along with a few specialists (9%), administrators (4%), and ‘others’ (e.g., resource teachers, partnership facilitators, 8%). The student percentages of those eligible for free lunch (7% to 14%) and reduced-price lunch (3% to 8%) were low. Three schools were classified as rural fringe, and four were classified as large suburban schools (National Center for Education Statistics, 2018).

Instrument

The original instrument on which this integration scale is based is called the *Beliefs Elementary Engineering for Teachers*, or *BEE-T*. It has been subjected to a psychometric analysis and is currently under review in an engineering education journal.

Background of BEE-T. Both an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) were performed on teachers’ responses to the BEE-T. The EFA allowed for the items to freely load on factors, while the CFA was an attempt to empirically confirm the proposed theoretical model. While the initial questionnaire consisted of 15 teachers' efficacy belief items and 15 teachers' beliefs items about the value of integrating curricular subjects (30 total items), the questionnaire was reduced down in two different iterations to 5 final efficacy belief items and 7 final belief items (12 total items). The correlation between the two factors was $r = .566$. The final model representing the final scale had a good fit ($\chi 2$ (70) = 53, $p < .054$; RMSEA = .055 (.000, .087); CFI = .991; TLI = .988; SRMR = .662; see Appendix A and B[2]). Using Cronbach alpha, the reliability of the teacher efficacy beliefs scale was $\alpha = .92$ and the reliability of the beliefs scale was $\alpha = .91$. These positive results provide preliminary evidence of the validity and reliability of the BEE-T scale; they therefore provide a conceivably good foundation for writing scale items for this integration scale.

Item changes of UCI21-T. Items from the BEE-T scale were modified into a new subject domain: from engineering to curriculum integration. Irvine (2002), a leader in item generation research generally describes the transfer of items that are automatically generated from one subject to another that are cognitive, assessing student knowledge or skill. However, attitudinal item transfer should also be possible. Items on teacher attitudes, specifically their beliefs about and efficacy beliefs towards elementary engineering, were shifted from measuring the subject domain of engineering to curriculum integration.

In modifying the items from the BEE-T scale, the team of integration experts generally replaced the phrases "engineering content," "engineering activities," and "engineering design process" with "integrated lessons," "integrated activities," and "the process of integration" (see Appendix C and Appendix D). The integration experts also added some new items that assess teachers' efficacy beliefs towards completing the different steps required to implement

[2] Appendix A consists of the list of BEE-T items after the scale has undergone extensive psychometric testing, while Appendix B consists of the CFA factor structure and loadings of the finalized BEE-T.

curriculum integration in their classrooms to further assess how effective general curriculum integration training in teacher professional development may be, whereas the engineering professional development teachers received that was the basis for the BEE-T scale development was specific to the content area of engineering (see Appendix E). The Alpine School District deemed this study was exempt from IRB Review as it evaluates the effectiveness of curricula and instructional techniques that are developed and administered in educational settings.

The integration questionnaire was administered three times in 2017 (twice in June and once in October) and one time in 2018. It underwent revisions from one administration to another, most notably between the second June and October 2017 questionnaires. Some items containing the word “Engineering Design Process” were present in the second June questionnaire but were deleted in the October 2017 questionnaire. Additionally, a series of items relevant to “problem-based learning” were present in the second June questionnaire but were removed in the October 2017 questionnaire (see Appendices F, G, and H). At the first two administrations which occurred at a professional development in June of 2017, the integration experts were still connecting integration to engineering activities and problem-based learning so there are several questions that tie back to those strategies.

The first June questionnaire was given on the first day of a four-day professional development opportunity for elementary teachers in grades K-6. The population represented six schools. Four of the schools only had K-3 teachers present and the other two schools had K-6 teachers present. The professional development training was focused on three major shifts: *curriculum*, *pedagogy*, and *assessment*. The main focus for these participants was on curriculum and pedagogy as the teachers unpacked the grade-level core for knowledge and skills, created integrated opportunities, and begin to engage in and see the benefits of integrated instruction.

The teachers also experienced several engineering design activities and problem-based lessons in an attempt to connect it to previous professional development. A posttest questionnaire was administered after the professional development completed, constituting the second administration that did not have any changes from the pretest.

The questionnaire was administered four months after the June professional development on October 2017 to measure increases or decreases in teachers' beliefs about and efficacy beliefs towards curriculum integration for the professional development in June. This constituted the third administration of the questionnaire. The integration experts in the school district were attempting to determine if the initial motivational shift they saw directly following the professional development would last once teachers returned to the classroom with their students.

As the understanding of the district personnel grew about integration and the practice was aligned throughout the district vision for integrated education (which had a focus on STEM [Science, Technology, Engineering, and Mathematics] integrated education), the questions and focus of the questions changed. Rather than simply measuring if teachers believed that integration was a good idea, they wanted to understand if teachers connected integration to higher student engagement, increased relevance, and as a form of good Tier 1, 2, and 3 instruction[3]. Additional questions were added to the questionnaire to get a sense of what integration looked like in these teachers' classrooms in terms of frequency, connection to other subjects, etc. The principles of integration taught during the training were also referenced in several questions as we were trying to assess teachers' beliefs about curriculum integration and efficacy beliefs towards curriculum integration for specific practices. Finally, questions were

[3] Tier 1 instruction is "high quality instruction," Tier 2 instruction is "data-based decision making," and Tier 3 instruction is "team-based problem solving" (Utah State Board of Education Teaching and Learning website, https://www.schools.utah.gov/curr/umtss). Scale items can be rewritten with relevant standards for whatever state or country in which the scale is administered in future administrations.

added to get a sense of how integrated instruction was being supported in their schools and what needs and next steps they needed to provide; these questions were open-ended questions and not scale-based and were not assessed in this study. The final administration was given to the same group of teachers towards the end of the school year in March of 2018. Serving as the final posttest, the questionnaire used in this fourth administration did not have any item changes from the questionnaire used in the third administration.

While these changes were being made to the questionnaire by educators in the Alpine School District from June 2017 to October 2017, the scale used to assess teachers' beliefs about and efficacy beliefs towards integrating engineering content (BEE-T), was simultaneously undergoing revisions by BYU researchers as it was subjected to exploratory and confirmatory factor analysis (EFA and CFA). Therefore, some items that were modified from the BEE-T were still present in the latest administrations of the UCI21-T, even though they were later deleted from the BEE-T scale as it underwent these revisions. The items analyzed in this dissertation are consistent with the item modifications made to the BEE-T and consisted of (a) seven belief items intended to assess perceived value of curriculum integration, (b) three items intended to assess general efficacy belief towards curriculum integration, and (c) seven process efficacy belief toward curriculum integration items (see Table 2). As it was unclear whether efficacy towards curriculum integration was best conceptualized as one or two factors, the data was initially looked at from both perspectives as both a two-factor scale (beliefs items about curriculum integration and efficacy beliefs towards curriculum integration, or [a] and [b + c]), or as a three-factor scale (beliefs about curriculum integration, general efficacy beliefs towards curriculum integration, and process efficacy beliefs towards curriculum integration, or [a], [b], and [c]).

Table 2

UCI21-T List of Items

Construct	Item #	Statement
Beliefs About Curriculum Integration	1	Integrated content and principles can be understood by elementary children.
	2	Integrated lessons should be taught to elementary children.
	3	Integration is an important part of Tier 1 standards.
	4	Integration is an effective form of Tier 2/3 instruction.
	5	Providing more integrated activities would enrich the overall learning of my students.
	6	Integration is an important part of the new curriculum standards.
	7	Students are more likely to see the relevance of a subject when it is integrated with other subjects.
General Efficacy Beliefs Towards Curriculum Integration	8	I believe that I have the requisite skill to integrate education.
	9	I can recognize how to integrate with all subject areas.
	10	I can describe the process of integration.
Process Efficacy Beliefs Towards Curriculum Integration	11	I can identify skills and dispositions associated with 21st century learning in my grade level.
	12	I can plan an integrated lesson in which each subject area maintains its integrity.
	13	I can plan an integrated lesson in which each subject area is tied back to established curriculum.
	14	I am confident that I can establish the priorities of an integrated lesson.
	15	I am comfortable differentiating between topics that ought to be integrated versus topics that shouldn't.
	16	I am confident in my ability to unpack the curriculum standards for knowledge, skills, and dispositions.
	17	I am effective at writing a lesson objective for an integrated lesson.

The UCI21-T adopted an additional property of the BEE-T beyond the wording of questionnaire items. The items were all positively oriented in the UCI21-T, as revisions were made in the construction of the BEE-T such that negatively oriented items were rewritten to be positively oriented. This was done as negatively-oriented items can reduce the reliability and validity of a scale and were deemed no longer needed in the final questionnaire as a check to see if participants were paying attention and not randomly checking response categories (Rich et al., under review). Also similar to the BEE-T, the UCI21-T scale had six response categories including “strongly disagree,” “somewhat disagree,” “disagree,” “agree,” somewhat agree,” and “strongly agree,” with no neutral “not sure” category. In these ways, the UCI21-T benefitted from the extensive psychometric testing done on the BEE-T.

Procedure

The fall pretest administered in October of 2017 was the first time the questionnaire was administered in its current form. It was selected as the data to use for this dissertation, as this was the largest gathering of teachers of the four questionnaire administrations and the questionnaire had all the new questions added to it. The June 2017 administrations were in the summer and preceded major changes to the questionnaire, and the March 2018 administration was not done in one location as the October professional development was presented at individual schools and not as many teachers were surveyed.

The questionnaires were administered through Qualtrics. The first 10 minutes of the professional development were devoted to the collection of questionnaire data, with an announcement being made where to the find the questionnaire link. Teachers were also informed that this link would remain live for a few days for them to fill in if they did not have a laptop with them at the time or if the questionnaire link did not work for some reason on their device. The data were exported from Qualtrics into SPSS Version 24.0, and duplicate cases were deleted, as some teachers began filling out the questionnaire more than once. The final sample included 196 cases.

Analysis

As the BEE-T was the foundation for the writing of the UCI21-T and it was well-tested and analyzed in a previous study (Rich et al., under review), just a confirmatory factor analysis (CFA), and not an exploratory factor analysis (EFA), was performed on the UCI21-T. This was followed up with a reliability analysis of the scales yielded by the CFA as possessing the best fit. The CFA was conducted using Mplus Version 8.1. Scale reliabilities were estimated using IBM SPSS Version 24.0.

Confirmatory Factor Analysis. A CFA was used to examine the relationship between the items and factors. After the initial review of the goodness-of-fit indicators, the parameter estimates from the CFA were examined to identify items that might be affecting the model fit adversely. This involved examining the standardized factor loadings and modification indices.

According to Brown, "CFA is almost always used during the process of scale development to examine the latent structure of a test instrument (e.g., a questionnaire). In this context, CFA is used to verify the number of underlying dimensions of the instrument (factors) and the pattern of item-factor relationships (factor loadings)" (2015, p. 1). Goodness of fit was determined by reviewing four separate indices. The first index to be considered was the root mean square error of approximation, or RMSEA, which assesses the fit between the implied covariance matrix and the sample covariance matrix. However, it has been noted that RMSEA can function differently with categorical data than with continuous data and may not be completely dependable (Monroe & Cai, 2015). The next indicators assessed were two comparative fit indices; these are the comparative fit index (CFI) and the Tucker-Lewis index (TLI). These indices assess how well a model fits when compared to a baseline, or null model. Both the CFI and the TLI characterize goodness-of-fit as their values approach 1.00 (Brown, 2015). An important difference between the two is that the TLI penalizes model complexity, as does the RMSEA. The SRMR is the standardized version of the residual-based model fit index. It indicates the closeness of the fit of the sample covariance matrix and the model implied covariance matrix (Wang & Wang, 2012). Relative measures of fit, such as the AIC and BIC, were not assessed in this study as they are available for continuous but not categorical indicators.

Hu and Bentler (1999) have suggested values for the RMSEA, CFI, TLI, and SRMR that can be deemed as possessing either "good" or "acceptable" fit. For good fit, they recommend values of .06 or lower for the RMSEA; .95 or higher for the CFI and TLI; and .08 or lower for the SRMR. For acceptable fit, the recommended values are .07-.10 for the RMSEA; .90-.94 for the CFI and TLI; and .09-.10 for the SRMR.

The CFA included an investigation of rival models representing alternative factor structures. These included: (a) a single-factor model, (b) multiple factors with moderate correlations, or (c) a bifactor model where items cluster together and load on a general factor, at the same time each cluster is loading onto distinct specific factors.

Reliabilityanalyses. Ordinal-level measures of reliability are an alternative to Cronbach's alpha that are more accurate with Likert-scale responses and were selected as the reliability coefficients to be used for this study since response options consisted of six ordered categories. McDonald's ordinal omega was selected instead of Cronbach's ordinal alpha, as Cronbach's alpha is an imperfect estimator of reliability due to the fact that it depends on tau-equivalence and the absence of correlated errors. McDonald's ordinal omega was calculated in this study by configuring SPSS with an integration plug-in for R that adds a command for calculating ordinal omega in the scale reliability functions already existing in SPSS (IBM Knowledge Center, n.d.).

Missing data. Potential bias can also result from missing data. The presence of a significant amount of missing data can skew the results of analysis; therefore it must be dealt with statistically using the correct method. There was not a significant amount of missing data in this dataset. Only .7% of the data in the beliefs about the value of curriculum integration items and .5% of the data in the efficacy beliefs towards curriculum integration items were missing. Missing data was nevertheless handled using Full Information Likelihood Method, or FIML, in Mplus. FIML has been shown to be better than list wise deletion or mean imputation (Enders & Bandalos, 2001).

CHAPTER 4

Results

Preliminary item analyses were performed on the individual items prior to being analyzed using CFA. There were some items where there was a not a good range of responses across the five response categories, with virtually all teachers agreeing or strongly agreeing with some items. For example, this was true of the item "Integrated lessons can help elementary students become more engaged in school," where responses were heavily weighted towards the "strongly agree" (73%) and "agree" (25%) categories; the other 2% of the respondents were in the "strongly disagree" category. No responses were present in the "not sure" and "disagree" categories. The responses to this item and other similar items appeared to indicate high teacher buy-in to the topic of integrated teaching. It also potentially revealed a social desirability response set in the way teachers answered as a result of what they believed the training they were required to attend was promoting. Based on these skewed responses, it was determined that the data would be analyzed as categorical instead of continuous.

Model Comparisons

To test the first research question of whether the hypothesized two-factor structure (beliefs about the value of curriculum integration and efficacy beliefs towards curriculum integration) was the best fit, models were compared. These included (a) a single-factor model; (b) a first-order model with two correlated factors; (c) a first-order model with three correlated factors; (d) a bifactor model with two specific factors; and (e) a bifactor model with three specific factors. The two-correlated-factor model and three-correlated-factor model that were run are both variations of a multiple-factor model. The two-correlated-factor model hypothesized the items would load onto the two factors analogous to the BEE-T: beliefs about why curricula should be integrated and sense of efficacy towards successfully integrating their curricula. The three-factor model was run as an additional model, as the efficacy belief items for the UCI21-T consisted of (a) items adapted directly from the BEE-T (Appendix D), and (b) curriculum integration efficacy belief process items written for the UCI21-T (Appendix E).

The single-factor model was analyzed first. The model converged, with the fit statistics approximating the recommended standards. The RMSEA was .17; the CFI was .89; the TLI was .87; and the SRMR was .18. The CFI and TLI were slightly under the recommended standard of .90. The SRMR was over the recommended standard of .08.

When the data were next constrained to a two-correlated-factor solution and run, it converged and demonstrated better fit than the single factor model. The RMSEA was .08; the CFI was .97; the TLI was .97; and the SRMR was .07. All four fit statistics were within the recommended standards. The correlation between the two factors was $r = .49$, indicating the two factors were correlated but not so highly correlated to be considered the same factor.

A model specifying three correlated factors was analyzed next and it also converged. Constraining the items to load into three correlated factors in the CFA demonstrated better model fit than either of the previous models. All four fit statistics were within the recommended ranges. The RMSEA was .05; the CFI was .99; the TLI was .99; and the SRMR was .04. It was found that the three factors were correlated. Beliefs about curriculum integration and general efficacy beliefs towards curriculum integration had an $r = .59$; beliefs and process efficacy beliefs towards curriculum integration had an $r = .41$; and general efficacy beliefs towards curriculum integration and process efficacy beliefs towards curriculum integration had an $r = .82$.

Finally, the bifactor models were analyzed. Both converged. For the bifactor model with two uncorrelated factors, the RMSEA was .07; the CFI was .99; the TLI was .99; and the SRMR was .03. For the bifactor model with three uncorrelated factors, the RMSEA was .07; the CFI was .99; the TLI was .99; and the SRMR was .03. See Table 3 for a side-by-side comparison of all model fit indices. There were no high cross-loading items in all of the models assessed. There were also no items that did not load on any factor. No correlated error terms or shared variance between individual items were found in any of the models.

Due to the presence of several high-fitting models, a few adjusted chi-square difference tests were run (see Table 4). The first was analyzed to compare the significance of the difference between the two-correlated-factor model and the three-correlated factor model, and significant differences emerged (χ^2 = 37.17; df = 14, p<.000). The highest fitting of all the models, the bifactor model with one general factor and two specific factors, was then tested against the two-correlated-factor model and the three-correlated-factor model. The bifactor model with one general factor and two specific factors was significantly different than both the two-correlated-factor model (χ^2 = 123.77, df = 16, p < .000) and the three-correlated-factor model (χ^2 = 40.43, df = 14, p < .000). Loadings for all items across the bifactor model with one general factor and two specific factors are presented in Table 5. See Figure 1 for the factor structure of the closely related two-correlated factor model. The three-correlated-factor model did have high fit statistics, potentially making the case that the efficacy beliefs towards curriculum integration factor should split into two factors: general efficacy beliefs towards curriculum integration and process efficacy beliefs towards curriculum integration. However, the correlation between the general efficacy beliefs items towards curriculum integration and the process efficacy beliefs items towards curriculum integration was *r* = .82, suggesting these factors are indeed highly correlated and could potentially be considered to be the same factor. Therefore, the three-correlated-factor model was deemed as non-viable.

Table 3

Fit Statistics for All Model (n = 196)

Model	χ^2	RMSEA	CFI	TLI	SRMR
One Factor	985.29	.17	.89	.87	.18
Two Correlated Factors	369.35	.10	.97	.97	.07
Three Correlated Factors	295.40	.05	.99	.99	.04
Bifactor Model with Two Uncorrelated Factors	188.16	.07	.99	.99	.03
Bifactor Model with Three Uncorrelated Factors	166.45	.06	.99	.99	.04

Table 4

Standardized Factor Loadings of Bifactor Model with One General Factor and Two Specific Factors (n = 196)

Item	Statement	General	Beliefs	Efficacy
1	Integrated content and principles can be understood by elementary children	.479	.815	
2	Integrated lessons should be taught to elementary children.	.650	.568	
3	Integration is an important part of Tier 1 standards.	.527	.741	
4	Integration is an effective form of Tier 2/3 standards.	.553	.717	
5	Providing more integrated activities would enrich the overall learning of my students.	.492	.718	
6	Integration is an important part of the new curriculum standards.	.502	.532	
7	Students more likely see relevance subject integrated with others.	.449	.801	
8	I believe that I have requisite skills to integrate education.	.832		.205
9	I can recognize how to integrate with all subject areas.	.864		.140
10	I can describe the process of integration.	.839		.277
11	I can identify skills and dispositions associated w/21st century learning in my	.468		.558
	grade level.	.663		
12	I can plan an integrated lesson in which each subject area maintains its integrity.	.663		.649
13	I can plan an integrated lesson in which subject area is tied back to established curriculum.	.669		.599
14	I am confident I can establish the priorities of an integrated lesson.	.649		.689
15	I am comfortable differentiating between topics that ought to be integrated versus topics that shouldn't.	.563		.619
16	I am confident in my ability to unpack curriculum standards for knowledge, skills, and dispositions.	.530		.619
17	I am effective at writing lesson objective for integrated lesson.	.551		.720

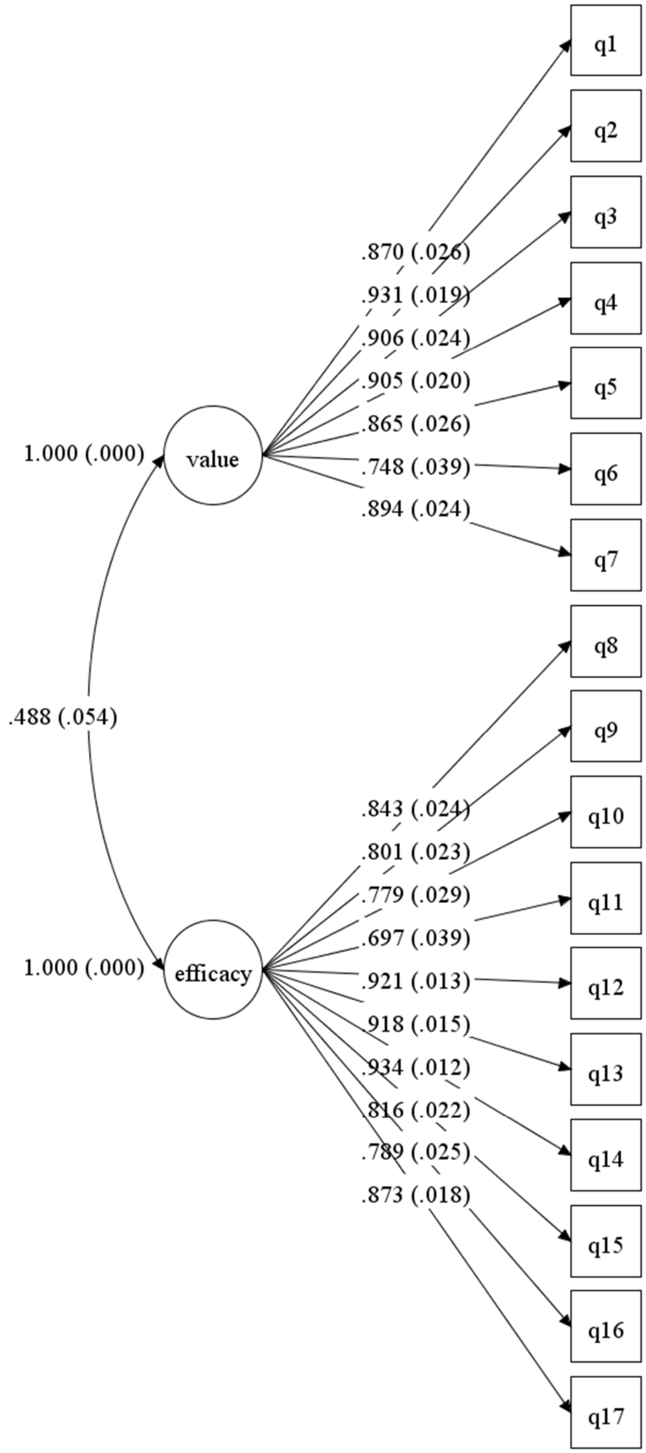

Figure 1. Two-Correlated-Factors Model and Standardized Loadings (n = 196)

Table 5

Results of Adjusted Chi-square Difference Tests (n = 196)

	Number of freely estimated parameters	Adjusted chi-square difference	Degrees of freedom	Probability
Test A:				
Three-correlated-factor model vs. two-correlated-factor model	83	37.17	14	.000
Test B:				
Two-correlated-factor model vs. bifactor with one general factor and two specific factors model	81	123.77	16	.000
Test C:				
Three-correlated-factor model vs. bifactor with one general factor and two specific factors model	83	40.43	14	.000

Reliability Estimates

The second research question addressed the reliability of each scale. The McDonald ordinal omega for each of the factors of the 2-correlated-factor solution was sufficiently high at $\Omega = .94$ for beliefs about the value of curriculum integration and $\Omega = .93$ for efficacy beliefs towards curriculum integration. Interestingly, the analysis also reported the Cronbach alphas for each analysis and in each case the values where identical to those of the McDonald ordinal omega (Table 6). There were no correlated error variances between any items in the scales.

Conclusions

All tested models had high fit statistics that were within adequate fitting ranges, making the decision of which model to select difficult. Empirically, the bifactor model with one general factor and two specific factors was the curriculum integration model that demonstrated the best fit. It had the best fit on three of the four important indicators. It had: (a) the highest CFI, (b) the highest TLI, and (c) the lowest SRMR. The adjusted chi-square difference tests furthermore found the bifactor model with one general factor and two specific factors to be the best fitting model when compared to the model with two correlated factors and the model with three correlated factors.

Table 6

Scale Cronbach Alpha and McDonald Ordinal Omega Reliabilities (n = 196)

	Number of items	Cronbach alpha	Alpha confidence interval (95%)	McDonald ordinal omega	Omega confidence interval (95%)
Beliefs about Value of Curriculum Integration	7	.94	.93, .95	.94	.93, .95
Efficacy Beliefs towards Curriculum Integration	17	.93	.92, .95	.93	.92, .95

CHAPTER 5

Discussion

The 21st Century Universal Curriculum Integration Scale–Teachers (UCI21-T), is the first scale to be successfully created and psychometrically tested for teachers that is designed to assess teachers' beliefs towards curriculum integration in general. It was based on an existing scale, the Beliefs Elementary Engineering –Teachers, or BEE-T, that was developed to assess teacher efficacy beliefs towards engineering education and beliefs about the value of engineering education implemented at the elementary school level, which has demonstrated evidence of validity and reliability. Modifying its use for curriculum integration was accomplished with the help of local integration experts. The work in this dissertation found the UCI21-T to demonstrate evidence of validity and reliability.

UCI21-T Conceptual and Empirical Model Fit

The fit on all models was quite clean with there being no correlated error terms, either within or between factors. The items fit best as a bifactor model with one general factor and two specific factors. One set of items loaded cleanly on beliefs about why it is important to integrate curricular subjects in elementary school and one on efficacy beliefs about implementing integrated curricular subjects, while all items also loaded onto a general factor. Chi-square difference tests indicated that this model fit better than the other competing models.

There was a possible explanation for why the efficacy items towards curriculum integration might fit better when split into general efficacy beliefs towards curriculum integration and process efficacy beliefs towards curriculum integration. As the *process* efficacy beliefs items towards curriculum integration ask teachers to assess their beliefs about how successfully they can implement the different steps of curriculum integration, these may load differently than the *general* efficacy beliefs items towards curriculum integration. If teachers have a high sense of efficacy towards one step in the process, they tend to have a high sense of efficacy towards the other steps in the process. Conceivably, a teacher could think of their efficacy towards curriculum integration in a general sense in a way that is different than their efficacy beliefs towards various steps in the process of curriculum integration, with the general efficacy towards curriculum integration items assessing efficacy that is something more than the sum of the parts, or steps, teachers need to know to administer curriculum integration. However, the two factors also possessed a high correlation (r = .82). Therefore, there was insufficient evidence of discriminant validity, or that the two factors were sufficiently unrelated to one another to be considered distinct. It would appear to be 'straining at a gnat' by conceptualizing the two efficacy factors as capturing something truly unique of one another and therefore the three-factor models were deemed as not viable.

In spite of the statistical evidence indicating the bifactor model with one general factor and two specific factors was the best fitting model, there are conceptual and practical reasons for scoring and analyzing the scale as a two-correlated-factor model: (a) one factor assessing teachers' beliefs about *why* it is valuable to integrate curricular subject matter, and (b) one factor assessing *how* to successfully integrate different subjects. Although it is possible to make a conceptual statement about the difference between the bifactor model with one general factor and two specific factors and the two-correlated-factor model, that distinction does not seem to be important from a practical standpoint. Whether or not all items loaded onto a general factor, curriculum specialists who use this scale are more likely to conceptualize it best as possessing two factors: one *why* factor and one *how* factor, *without reporting a general overall score*. The law of parsimony states that the simplest explanation is the best one, and the evidence in its totality points to the utility of conceptualizing and reporting the results of (a) a beliefs towards the value of curriculum integration subconstruct and (b) an efficacy beliefs towards curriculum integration subconstruct. Hence, the two-correlated-factor model depicted in Figure 1 makes the most sense for the UCI21-T, theoretically and practically, compared to the bifactor model with one general factor and two specific factors depicted in Table 5, three-correlated-factor model, and the bifactor model with one general factor and three specific factors.

Comparison of UCI21-T to Existing Scales

The review of the literature found that there was a dearth of scale-based measures on curriculum integration, confirming the need for the development of a new scale such as the UCI21-T. Only two existing studies found in the literature assessed curriculum integration at a general level. Etheridge (1973) used a Teacher Attitudinal Inventory consisting of 85 items that contained some items on teaching using an interdisciplinary approach, such as "An essential component of a good lesson is one of showing how it is related to other areas of knowledge." It also had some items relevant to an inquiry-based approach, such as "Group activity teaches children to think and plan together, independent of direct supervision by the teacher." However, it also contained many items not relevant to an interdisciplinary approach, such as "In the interest of good discipline pupils who repeatedly disrupt the class must be severely punished." Godt et al. (2000) studied teachers who were redesigning their teacher education program. They selected 13 of 57 items of a Teacher Belief Inventory that "were related to goals of the University's teacher education program" at the University of Wisconsin-Madison. The Godt et al. scale contained items directly assessing teachers' beliefs about the value of curriculum integration, e.g., "I would teach the knowledge of different subject areas separately, because important knowledge is overlooked when subjects are integrated." Other items were relevant to 21st

century skills, such as collaboration, e.g., "One of the most important tasks I would face as a teacher is developing individuals into a good working group." There were a few items related to inquiry-based, more self-directed learning, such as "Learners should have some choice in the selection of classroom materials." It also contained items that were seemingly not quite so directly related to curriculum integration, such as "Parents would have the right to visit my classroom at any time if they gave me prior notice."

Unlike the Godt et al. (2000) study, the UCI21-T is adapted from more of a professional development standpoint than a teacher education program standpoint; in fact, many of the scales found in the literature review are designed for use on preservice teachers and thus the UCI21-T provides something new. The UCI21-T would be particularly relevant to school districts placing priority on this kind of education, through professional developments, requiring teachers to pursue inquiry-based learning approaches in their classrooms, etc. This could include schools with a STEM focus, as any combinations of science, technology, engineering, and mathematics would be classified as curriculum integrated teaching. It would also be relevant to curriculum integrated education that is more generally focused on all the subject combinations rather than just STEM.

The UCI21-T is not very similar to scales in Table 1 other than those in the Etheridge (1973) and Godt et al. (2000) studies. These other scales are largely tied to whatever specific subjects are being integrated and thus their broad application to curriculum integrated teaching is problematic. The UCI21-T, on the other hand, can be used in cases where there are no existing scales available for assessing the teaching of specific subject combinations, such as reading and social studies; therefore, it has much broader applicability than the existing scales on curriculum integration.

The UCI21-T is based on the 'generic' curriculum integration model developed by Drake and Burns (2004). The Drake and Burns research has a focus on curriculum integration that can survive in an era of high-stakes testing. Hence, the UCI21-T scale contains items relevant to standards, such as "Integration is an important part of the new curriculum standards" and "I am confident in my ability to unpack curriculum standards for knowledge, skills, and dispositions." It would be particularly relevant to administrators implementing curriculum integration who are concerned and feel pressure to help curriculum integrated teaching survive in the high-stakes testing era. By contrast, only two of the 22 teacher scales found in Table 1 had items that were relevant to standards. These studies measure teacher confidence and comprehension of standards, with Deal et al. (2009) discussing health and reading standards and Doyle et al. (2014) describing how existing critical thinking and language arts standards can be used for assessing art integration, which as a more peripheral subject may have less standards specifically written about it. The standards based items in the UCI21-T would seem to provide a general measure of confidence and competence that would encompass the subject combinations found in these studies, as well as many others.

Study Limitations and Recommendations for Future Research

Similar to the UCI21-T, studies cited in Table 1 contain scales measuring mostly the beliefs and efficacy belief towards various subject combinations. A few of the scales measured a different concept, teacher knowledge, which also seems subject to professional development influence. Potentially, the UCI21-T could be modified in the future, adding questions for this construct. Teacher knowledge is assessed in some of the less common subjects being taught at the elementary school level, such as engineering (Berry, 2017) and understanding of the relationship between arts, creativity, and cultural education (Cervato & Kerton, 2017).

Questions regarding teacher knowledge of some of the new and upcoming subjects now being administered at the elementary school level, such as earth and space science, engineering, environmental education, technology, etc. could potentially be added to the UCI21-T as these new subjects are taught more frequently at the elementary school level, such as "I have sufficient knowledge to teach any subject, traditional and non-traditional, that I may be required to teach in elementary school."

The literature review also found that 15 of the 22 scale-based studies studying two or more content areas being combined only measured one subject domain, e.g., when combining science and social studies, only a scale for teacher efficacy beliefs towards science was found (Ford et al., 2012). The literature review further found that maintaining the integrity of each content area integrated was more of a problem for teachers for the arts than for the sciences, as the sciences are often given priority (Roucher & Lovano-Kerr, 2010). The UCI21-T compensates for these weaknesses with the item "I can plan an integrated lesson in which each subject area maintains its integrity." Once teachers are measured by this standard, they should become more balanced in their approach when combining a science with an art. Hopefully more scales will be constructed in the future that assess teacher efficacy beliefs on each subject being integrated, and not just one.

Now that this first attempt at a curriculum integration scale has demonstrated evidence of validity and reliability, the scale can assess teachers' beliefs about the importance of curriculum integration and efficacy beliefs towards curriculum integration. This can be done as a way to measure their initial receptivity to curriculum integration before any professional development has been implemented, which may help administrators tweak administrations of their professional developments on curriculum integration before they even begin. It can also be used in assessing the effectiveness of professional development for teachers that covers curriculum integration by administering it in a pre-post design. For example, teachers and professional developments could be strong in some steps of curriculum integration and weak in others, e.g., being strong in unpacking the standards for subjects, skills, and dispositions while being weak in writing objectives for integrated lessons. After areas where teachers are weak are identified, professional developments could be changed either before or after they are administered in any particular setting.

As mentioned at the beginning of this dissertation, the UCI21-T may not be appropriate for all types of curriculum integration, as there is a diversity of ways curriculum is integrated. It does function as a good starting point. The scale should also be tested for its generalizability when administered in environments that are different from the majority White and economically advantaged one used in this study. A measurement invariance test could assess how the scale functions with a more ethnically diverse, less economically advantaged sample. It would also be interesting to see how teachers who are studying the process of integrating education differently than this professional development in Utah County, Utah would respond to these same set of items. This may include teachers in other countries and cultures outside of the United States, where it was conducted. There are various ways that curriculum integration has been conceptualized over its more than 100-year development, and variations of how it is conceptualized and integrated likely vary across the world. Additional psychometric analyses can be performed on modified scales to see if and how the factor structure is affected. The scale can possibly be modified, adding or deleting items, for studying curriculum integration conceptualized differently than is found here. Exciting new avenues of research are possible now that this scale on curriculum integration exists.

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APPENDIX A

BEE-T List of Items

Table 7

BEE-T List of Items

Item	Statement
1	Engineering content and principles can be understood by elementary school children.
2	Learning about engineering can help elementary students become more engaged in school.
3	Engineering concepts should be taught to elementary school students.
4	Engineering is a 21^{st} century skill that is as important as “the basics” (Reading, Writing, Arithmetic).
5	Providing more in-class engineering design activities would enrich the overall learning of my students.
6	Engineering content is an important part of the new science standards.
7	Engineering concepts should be taught much more frequently in elementary school.
8	I believe I have the requisite science skills to integrate engineering content into my class lecture.
9	I can recognize and appreciate the engineering concepts in all subject areas.
10	I can describe the process of engineering design.
11	I believe that I have the requisite math skills to integrate engineering content into my class lessons.
12	I can create engineering activities at the appropriate level for my students.

APPENDIX B

BEE-T CFA Factor Structure and Standardized Loadings (n=109)

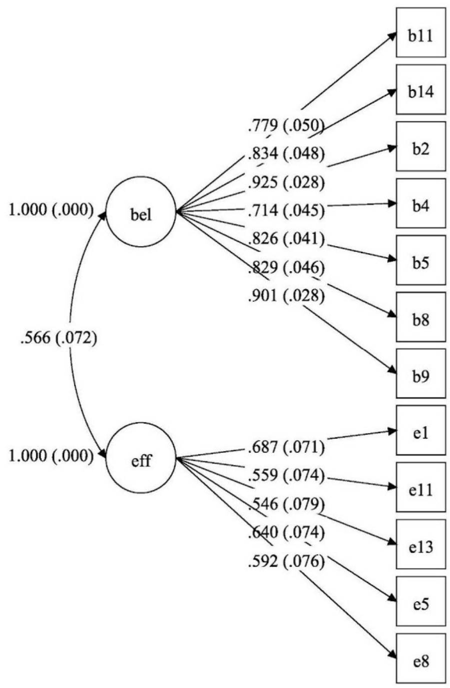

Figure 2. BEE-T CFA factor structure and standardized loadings (n=109)

APPENDIX C

Comparison of UCI-T Curriculum Integration Items with BEE-T Elementary Engineering Items, Beliefs

#	BEE-T item	#	UCI21-T item
1	Engineering content and principles can be understood by elementary	1	Integrated content and principles can be understood by elementary children.
2	Learning about engineering can help elementary students become more. engaged in school.	N/A	
3	Engineering concepts should be taught to elementary children.	2	Integrated lessons should be taught to elementary children.
4	Engineering is a 21st century skill that is as important to teach as "the basics" (Reading, Writing, Math).	3	Integration is an important part of Tier 1 instruction.
5	Providing more in-class engineering activities would enrich the overall learning of my students.	4	Integration is an effective form of Tier 2/3 instruction.
6	The engineering design process is an important part of the new science standards.	5	Providing more integrated activities would enrich the overall learning of my students.
7	Engineering concepts should be taught much more frequently in elementary school.	6	Integration is an important part of the new science standards.
N/A		7	Students are more likely to see the relevance of a subject when it is integrated with other subjects.

APPENDIX D

Comparison of UCI-T Curriculum Integration Items with BEE-T Elementary Engineering Items, Beliefs

#	BEE-T item	#	UCI21-T item
8	I believe that I have the requisite science skills to integrate engineering content into my class lessons.	8	I believe that I have the requisite skill to integrate education.
9	I believe that I have the requisite math skills to integrate engineering. content into my class lessons.	N/A	
10	I can recognize and appreciate the engineering concepts in all subject areas.	9	I can recognize how to integrate with all subject areas.
11	I can describe the process of engineering design.	10	I can describe the process of integration.
12	I can create engineering activities at the appropriate level for my students.	N/A	

APPENDIX E

Process Efficacy Beliefs towards Curriculum Integration Items Added to Questionnaire

Item	Statement
11	I can identify skills and dispositions associated with 21st century learning in my grade level.
12	I can plan an integrated lesson in which each subject area maintains its integrity.
13	I can plan an integrated lesson in which each subject area is tied back to established curriculum.
14	I am confident that I can establish the priorities of an integrated lesson.
15	I am comfortable differentiating between topics that ought to be integrated versus topics that shouldn't.
16	I am confident in my ability to unpack the curriculum standards for knowledge, skills, and dispositions.
17	I am effective at writing a lesson objective for an integrated lesson.

APPENDIX F

Beliefs about Value of Curriculum Integration Item Changes across Questionnaires

June 2017 pre and post questionnaires	October 2017 follow-up questionnaire
Integrated lessons should be taught to elementary school students.	Retained
Integrated content and principles can be understood by elementary school students.	Retained
Providing more integrated activities would enrich the overall learning of my students.	Retained
Integrated lessons can help elementary students become more engaged in school.	Retained in questionnaire, but not used in final analysis
The engineering design process can be integrated with other subjects and standards.	Dropped
I can teach integrated lessons as well as I teach non-integrated lessons.	Dropped
I can articulate what students should be able to do as a result of my teaching.	Dropped
I can explain the engineering design process well enough to integrate it with other subjects.	Dropped
Multiple objectives can be met in one integrated lesson.	Dropped
Student learning can be measured in integrated lessons.	Dropped
Teacher collaboration is important to successful integration.	Dropped
Administrators play an important role in establishing a culture of integration.	Dropped
--	(Added) Integration is an important part of the curriculum standards for elementary students.
--	(Added) Integration is an effective form of Tier 1 instruction.
--	(Added) Integration is an effective form of Tier 2/3 instruction.
--	(Added) Students are more likely to see the relevance of a subject when it is integrated with other subjects.

APPENDIX G

Efficacy Belief towards Curriculum Integration Item Changes across Questionnaires

June 2017 pre and post questionnaires	October 2017 follow-up questionnaire
I have the requisite content knowledge to integrate various subjects into class lessons.	I **believe that I** have the requisite content knowledge to integrate various subjects into class lessons.
I am confident that I can teach integrated lessons.	Retained in questionnaire, but not used in final analysis
My current teaching situation lends itself to teaching integrated lessons.	Retained in questionnaire, but not used in final analysis
I can explain how integrated lessons are connected to core curriculum standards.	Retained in questionnaire, but not used in final analysis
I can identify skills and dispositions associated with 21st century learning in my grade level curriculum.	Retained in questionnaire, but not used in final analysis
--	(Added) I can recognize how to integrate with all subject areas.
--	(Added) I can explain integration well enough to be effective in teaching in an integrated way.
--	(Added) I am capable of measuring student learning in integrated lessons.
--	(Added) I can plan an integrated lesson in which each subject area maintains its integrity.
--	(Added) I can plan an integrated lesson in which each subject area is tied back to established curriculum standards.
--	(Added) I am confident that I can establish the priorities of an integrated lesson.
--	(Added) I am comfortable differentiating between topics which ought to be integrated versus topics that shouldn't.
--	(Added) I am confident in my ability to unpack the curriculum standards for knowledge, skills, and dispositions.
	(Added) I am effective at writing a lesson objective for an integrated lesson.

Note. Bolded words indicate changes made to a questionnaire item

APPENDIX H

Problem-Based Learning Belief towards Curriculum Integration Items Deleted across Questionnaires

June 2017 pre and post questionnaires	October 2017 follow-up questionnaire
Problem-based learning looks different in each content area but can be found throughout the curriculum.	Dropped
Problem-based learning is tied to the 21st century knowledge, skills, and dispositions.	Dropped
Problem-based learning facilitates greater depths of knowledge.	Dropped
Problem-based learning opportunities serve as a common thread for integration.	Dropped
The Engineering Design Process if a problem-based strategy used to teach the elementary content.	Dropped