The Thesis Committee for Holly Elizabeth Griffin
Certifies that this is the approved version of the following thesis:

The Connection between Perceived Teacher Enthusiasm and Near Transfer in Secondary English and Physics

APPROVED BY
SUPERVISING COMMITTEE:

Supervisor:

Diane Schallert

Andrew Butler

The Connection between Perceived Teacher Enthusiasm and Near Transfer in Secondary English and Physics

by

Holly Elizabeth Griffin, B.A.; B.S.R.T.F.

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Dedication

For my family,

friends,

former & future students.

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Thank you to my parents, Allan and Janet, for supporting me through all of my educational endeavors, never letting me doubt myself, and for thinking I'm funny.

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Abstract

The Connection between Perceived Teacher Enthusiasm and Near Transfer in Secondary English and Physics

Holly Elizabeth Griffin, M.A.

The University of Texas at Austin, 2016

Supervisor: Diane Schallert

The literature on teacher enthusiasm has developed broadly and rapidly over the last two decades, and it has reported correlations with several student outcomes including performance and interest. This paper applies the Keller, Goetz, Becker, Morger, and Hensley (2014) conceptualization of dispositional teacher enthusiasm, which incorporates both affect and expressivity, to hypothesize significant positive relationships between teacher enthusiasm and near transfer of knowledge. In this study, immediately after a lesson was concluded, high school students (n=67) and teachers (n=8) were surveyed on classroom emotions, experiences, and perceived enthusiasm using Kunter et al.'s (2008, 2011) adapted teacher enthusiasm scale. Participants came from four English II classes, and four physics classes. Two weeks after the lesson with associated learning objectives (Texas Essential Knowledge and Skills), the students were tested on their mastery of the content with questions measuring their application level understanding. Based on correlational analysis, students who perceived teachers as enthusiastic did not perform significantly better on cumulative tests of knowledge, but all affective variables measured

were significantly correlated with each other. Lastly, possible mediating factors and future directions are discussed.

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Chapter 1: Introduction

Many students find it difficult to stay engaged and interested in their classes. This struggle becomes especially true in the secondary environment when content can be challenging and students involve themselves with many other responsibilities. Teachers employ techniques and activities to help all students succeed even when they are uninterested. Often, adults recollect a favorite teacher that made class more enjoyable than any other, and anecdotally, enthusiasm is a common attribute ascribed to such teachers.

Practically, societies invest in education in hopes of continuing innovation and progress. One way learners' acquisition of new knowledge is tested is by how well learned information is applied to new contexts: an idea known as far transfer. However, this type of transfer is difficult to control, predict, or prove. By contrast, near transfer happens in classrooms every day. Students learn specific content and demonstrate their mastery on homework, quizzes, and tests. To extend previous investigations of the effect of teacher enthusiasm, I wanted to explore its relationship to near transfer with high school students in two different subject areas of secondary education.

As early as 1970, researchers were interested in quantifying the link between teacher enthusiasm and student performance. Rosenshine (1970) reviewed early experiments addressing this important classroom interaction and found evidence supporting student perceptions of high teacher enthusiasm being linked with high student achievement. Many studies since then have reported similar positive student outcomes

like interest and enjoyment (Kunter et al., 2013) associated with teacher enthusiasm. Long and Hoy (2006) also expressed positive outcomes based on *teachers'* interest. Reciprocally, Kunter, Frenzel, Nagy, Baumert, and Pekrun (2011) found that "teaching enthusiasm was more likely to be influenced by students' motivation and behaviors in the classroom whereas subject matter enthusiasm seemed independent of students' characteristics and responses" (Kim & Schallert 2014, p. 136). Examining teacher enthusiasm outside the context of the classroom, studies have also shown that teacher enthusiasm is positively related to job and life satisfaction, as well as enjoyment of teaching (Frenzel et al., 2009). Keller, Goetz, Hoy, and Frenzel (2015) conducted an extensive review of more recent articles and book chapters in an effort to explore different conceptualizations, related constructs, and highlighted key connections with teachers' experiences that have surfaced since Rosenshine's (1970) review.

In the educational arena, students are faced with many other competing factors that influence their learning. This study seeks to highlight the relationship between teacher enthusiasm and transfer, a theoretically important construct. As described by Barnett and Ceci (2002), "…transfer provides an important test-bed for models of learning and performance, a point cogently made by Singley and Anderson (1989): The definition and assessment of performance models often turn on whether learned behaviors are permanent and, if so, whether they are applicable in novel contexts" (p. 613). This study was designed to investigate the degree to which a teacher's enthusiasm was related to students' ability to transfer and utilize knowledge in a close context, increasing their potential success on classroom assessments.

TEACHER ENTHUSIASM

The educational psychology field has had trouble defining teacher enthusiasm, partly because enthusiasm incorporates various facets. As Kunter et al. (2011) aptly described, "Enthusiasm does not have a specific, accepted definition in psychology, and it carries somewhat different connotations in different areas of research in educational psychology (p. 289)." To address this problem, Keller et al. (2014) proposed a new conceptualization of teacher enthusiasm that incorporates both positive affect and positive emotional expressivity. *Positive affect* incorporates the ideas of enjoyment, engagement, and pleasure derived from the teaching experience. *Emotional expressivity* refers essentially to how people show their emotions to others. Usually this can be demonstrated in a negative or positive fashion, and in this examination, it is important to highlight that having positive emotional expressivity can be perceived as teacher enthusiasm. To address this issue, Kunter et al.'s (2008, 2011) scale of teacher enthusiasm incorporates both of these aspects. Keller et al. (2014) found that their conceptualization of teacher enthusiasm was a predictor for students' perceived enthusiasm, which in turn related to students' interest. Echoing these views, and Frenzel et al.'s (2009) study, my study measured students' perceptions of their teachers' enthusiasm because at the high school level, students are capable of recognizing and appreciating their teachers' emotions and enjoyment of teaching as well as reporting fairly accurately on their own emotional experience. As Keller et al. (2015) explained, **"**although the validity of students' perceptions can be questionable, some research studies on instructional quality have demonstrated that students' aggregated perceptions of

instruction provide a reliable measure of classroom processes (see, for instance, Kunter and Baumert 2006; Lüdtke et al. 2006)" (p.13).

In addition to the trouble with a clear definition, there is at least one other factor limiting the current research. Most teacher enthusiasm studies have focused on the interaction between students' and teachers' affective traits. These are supremely important, and, in fact, since the 1960's, teacher enthusiasm has been described as "a key element of effective, high-quality teaching (e.g., Brophy & Good, 1986), a desirable characteristic of good teachers (e.g., Feldman, 2007), and an essential ingredient of supportive classrooms (e.g., Kunter et al., 2008)" (Keller et al. 2014, p.29). However, even if the student-teacher relationship can affect student emotions, behaviors, and outcomes, it does not necessarily *predict* student learning. The current study sought to determine whether teacher enthusiasm as an instructional tool was predictive of near transfer of knowledge.

Kim and Schallert's (2014) work on teacher and peer enthusiasm in college students eloquently discussed how some of the factors within the educational realm interacted with each other. They examined initial interest, background knowledge, motivation for affiliation with the teacher, motivation for affiliation with peers, perceptions of teacher enthusiasm, perceptions of peer enthusiasm, hold interest, and catch interest. They found significant positive correlations between most of these factors, but some noteworthy findings included that "perceptions of teacher enthusiasm was significantly correlated with six variables but was not associated with initial interest and background knowledge…" and "Interestingly, perceptions of peer enthusiasm and

motivation for affiliation with peers were significantly correlated with all eight variables, though the correlation with background knowledge was negative" (Kim & Schallert 2014, p. 140). I hoped to further the field's understanding of teacher enthusiasm by examining slightly different elements, as well as changing the arena from college classrooms to high school ones.

TRANSFER

The history of research on transfer extends farther back than the research on enthusiasm. In 1901, Thorndike and Woodworth were pioneers in the field of transfer. They wanted to rethink the learning experience and the idea of a "formal discipline." Through their experimental studies, a new path was created for future researchers to investigate conditions that improve or impede transfer of knowledge. Unfortunately, like teacher enthusiasm, there are many discrepancies in this field. A century later, Barnett and Ceci (2002) claimed "…there is little agreement in the scholarly community about the nature of transfer, the extent to which it occurs, and the nature of its underlying mechanisms" (p. 612). Bransford and Schwartz (1999) also documented the disenchantment with the literature on transfer because of the difficulty of documenting positive transfer. However, not all educational psychology researchers are pessimistic, and many studies have shown promising results indicating previous learning transferring onto new experiences.

Figure 1. Context of Transfer[1]

	Near	⟷	**Far**
Knowledge domain	Mouse vs. rat	⟷	Science vs. art
Physical context	Same room at school	⟷	School vs. beach
Temporal context	Same session	⟷	Years later
Functional context	Both clearly academic	⟷	Academic vs. at play
Social context	Both individual	⟷	Individual vs. society
Modality	Both written, same format	⟷	Lecture vs. wood carving

To understand transfer's importance in my study, it is necessary to discuss the two main types: near and far. Barnett and Ceci (2002) created a taxonomy for the context and content of transfer displaying a continuum for these elements. As shown in Figure 1, there are many domains necessary for understanding the context of transfer, or when and where knowledge is transferred. As mentioned previously, it has been difficult for researchers to prove the effects of far transfer because so many other factors cannot be controlled in normal school environments. Therefore, I chose to study class-specific content that mostly falls under the "near" side of the spectrum. When participating students took their class exam, they were tested on the three content categories presented by Barnett and Ceci: learned skill, performance change, and memory demands. Bransford and Schwartz (1999) stated, "different kinds of learning experiences can look equivalent given tests of memory yet look quite different on tests of transfer. Measures of transfer provide an especially important way to evaluate educational success" (p.62). Therefore I

[1] Adapted from Barnett and Ceci (2002)

only utilized test questions that required more than memory demands, and these will be discussed further in the methods section.

Bransford and Schwartz (1999) declared, "one important finding from research is that effective transfer requires a sufficient degree of original learning" (p. 63). In the current study, students were exposed to new material with which they should have had no prior experience, so this essential element exists. We also know that emphasizing metacognition, providing concrete details, presenting concepts in multiple contexts, as well as allowing students solve content-related problems, instead of present facts are all beneficial to transfer (Bransford & Schwartz, 1999). These are all simple instructional methods that teachers can employ in their classroom without also having to be enthusiastic. Thus, the current study aspired to bridge these two ideas together. When observing the lessons, I paid close attention to the use of these and other strategies so as to discuss potential results being mediated by other factors than teacher enthusiasm. As discussed previously, in educational settings many factors play vital roles such as engagement, interest, motivation, and goals. Any one of these factors may mediate the students' perceived enthusiasm because of their prior experiences and understanding, yet if teacher enthusiasm can be predictive of near transfer, then there is potential to help all students, especially struggling students, with relatively minor behavioral adjustment on the teacher's part.

THE CURRENT STUDY

The goal of this study was to confirm previous results of positive significant correlations between teacher enthusiasm and student interest, engagement, and enjoyment. Uniquely, this study examined the specific relationship of teacher enthusiasm and student near transfer as demonstrated by success on an assessment. At the conclusion of a lesson addressing specific course content, students reported on their experiences through a survey focusing on classroom emotions, engagement, and enjoyment as well as perceived teacher enthusiasm during a particular lesson. The content covered in the lesson was tested a few classes later in a formal setting to examine the amount of transfer for students. Teachers also completed a survey regarding classroom experience and self-analysis of enthusiasm. I predicted that students who perceived their teachers as enthusiastic would perform better on the delayed content test. I also predicted that there would be positive significant correlations between student self-reported enjoyment, engagement, and interest with both perceived and self-reported teacher enthusiasm.

Chapter 2: Literature Review

TEACHER ENTHUSIASM

As discussed in the introduction, the research involving teacher enthusiasm thus far has been difficult to link because of the lack of a clear definition. The current study implemented the best-supported definition of teacher enthusiasm available at the time; Keller et al. (2014) "brought together existing conceptualizations of expressiveness and positive teacher affect in an integrative concept of dispositional teacher enthusiasm" (p. 36). During the course of my research, Keller et al. (2015) released a comprehensive review of studies documenting teacher enthusiasm over the past 45 years.

The main controversy within this field has stemmed from the multitude of variables that factor into enthusiasm and how they interact: nonverbal expressiveness, instructional behaviors, immediacy, experience, enjoyment, intrinsic value, and passion. Keller et al. (2015) addressed each of these constructs individually with research supporting each variable's connection to enthusiasm and recommended that teacher enthusiasm should not be examined with a dualistic approach, reiterating and furthering their position from before. "We consider both behavioral and affective approaches to teacher enthusiasm to be equally valid because both have been shown to be relevant factors with regard to desirable student outcomes and teachers' professional lives; nonetheless, both have their drawbacks" (p. 8). Investigating these approaches individually prevents seeing the entire picture behind a teacher's enthusiasm.

Ultimately, Keller et al. (2015) redefined teacher enthusiasm as the "conjoined occurrence of positive affective experiences, that is, teaching-related enjoyment, and the behavioral expression of these experiences, that is (mostly nonverbal), behaviors of expressiveness" (p. 9). This clearer definition could simplify the various lines of current research, but further empirical support for construct validity is needed and consensus among researchers has yet to be acquired.

POSITIVE AFFECT

Although it is sometimes forgotten (especially by students), teachers have emotions like everyone else. In fact, many secondary teachers begin pursuing an educational career because of the love or passion of a certain subject. Vallerand et al. (2003) identified two types of passion, and asserted a relationship between harmonious passion and positive affective experiences during and after activities.

One part of the description of teacher enthusiasm for my study is the affective component. Various descriptions of this component have manifested over the past five years. Keller et al. (2014) stated "teacher enthusiasm as a personality trait can be defined as a tendency to experience positive affect during teaching" (p. 30). Earlier, though still in line with more current suggestions, Kunter et al. (2011) "regard[ed] enthusiasm as an affective, person-specific characteristic that reflects the subjective experience of enjoyment, excitement, and pleasure, and that is manifested in certain teacher behaviors in the classroom" (p. 290). Those behaviors constitute the expressivity component, which I will discuss further below.

POSITIVE EXPRESSIVITY

Individuals experience emotions in myriad ways, and express them in even more. When it comes to the classroom, teachers monitor how students are expressing their emotions for behavioral and academic reasons. Kim and Schallert (2014) pointed out, "Teacher enthusiasm has been considered a part of a teacher's arsenal, a strategy to influence students' performance by displaying a high energy level and interest in the subject matter" (p.136).

In this study, the verbal and nonverbal ways a teacher expresses emotions, and how students perceive those emotions was of particular importance. Keller et al. (2015) reported that, "Frenzel et al. (2009a, b) and Kunter et al. (2008) have shown substantial correlations between teachers' experiences of enjoyment and students' perceptions of teachers' displayed enthusiasm. Additionally…Patrick and colleagues (2000) cross-validated student-perceived teacher enthusiasm with observer ratings of teachers' nonverbal expressiveness" (p. 15). The analysis at hand specifically encompassed how students feel and perform. Also, because teacher expressiveness is an exhibited quality that must be perceived by others, it made sense to incorporate student perceptions to acquire the overall feelings of the class and each individual's experience.

STUDENT INTEREST

Academic interest has been researched extensively because of its important interactions with other emotional and motivational behaviors. Following previous work on motivation and goals with Self-Determination Theory (SDT), Ryan and Deci (2000)

reviewed current work in the field and declared, "the most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome" (p. 55). Educators struggle with helping students feel intrinsic motivation and thus supporting inherent interest because most schoolwork results in grades, which are outcomes not always directly representative of learning. Potentially, the more interest a teacher can elicit within a subject or class, the more intrinsic motivation the student may experience, and the better outcomes can be.

Hidi and Renninger (2006) describe interest as, "a psychological state that, in later phases of development, is also a predisposition to reengage content that applies to in-school and out-of-school learning and to young and old alike" (p.111). They created a four-phase model to explore how interest develops, which is central for the school environment because students bring diverse backgrounds to the classroom, and engage with content differently. The model includes triggered situational interest, maintained situational interest, emerging individual interest, and well-developed individual interest. Hidi and Renninger (2006) described interest development as representing this sequential order because "the characteristics of each phase of interest may be considered mediators of subsequent development and the deepening of interest" (p. 115).

In this study, the two main components of interest I examined included affect and value. Krapp (2007) discussed how academic interest reflects students' enjoyment (affective component) and personal value (value component). Keller et al. (2014) found that dispositional teacher enthusiasm was significantly related to students' interest and

pointed out that a student's "interest is likely to benefit from teacher enthusiasm based on two central mechanisms -- value induction and emotional contagion" (p. 29). In turn, these variables could lead to positive classroom emotions and experiences, intrinsic motivation, and/or better performance outcomes and thus the relationship between student interest and teacher enthusiasm requires more examination.

STUDENT ENGAGEMENT

Similar to interest, student engagement has been tied to motivational characteristics within school contexts. Kunter et al. (2011) reported that these variables both have, "an experiential component of joy and excitement during engagement with an object or activity. This experience, which is often associated with a feeling of meaningfulness, is seen as a motor for engaged behavior (Pintrich, 2003a)" (p. 290). According to SDT (Deci and Ryan, 1985) a student will engage in learning when they are intrinsically motivated because it is pleasurable and satisfying. Research has shown one successful way teachers foster engagement with their students is by presenting their own interest and excitement about the topic (Patrick et al., 2003; Turner et al., 1998), which to many scholars is considered teacher enthusiasm, and thus important to the study at hand.

TRANSFER

Barnett and Ceci (2002) sought to define a framework for transfer to assist in future understanding of how transfer occurs, and what teaching practices could, "be optimally tailored to promote transfer—and the mechanisms underlying the transfer

process" (p. 612). Realistically acknowledging the individual characteristics that also play a role in this complex cognitive process, the authors suggest nevertheless how important it is to be able to transfer what has been learned in the classroom to outside situations (e.g., using math to manage finances, using writing skills to communicate professionally, or applying science concepts like chemical combustion to assure safety in the home).

In their review of seminal, modern studies, Barnett and Ceci (2002) focused on far transfer primarily because of the educational and political implications. Bransford and Schwartz (1999) reviewed 100 years of work on transfer, documenting exemplars of studies focused on both near and far transfer. One major takeaway is that, "the manner in which information is learned…affects subsequent transfer" (p. 64). Specifically they discussed how concrete examples could enhance initial learning, and when a concept is presented many different ways, the likelihood of transfer can be increased. Many opportunities exist within the secondary classroom to incorporate knowledge from other classes, and thus present content in different contexts, but this requires arduous coordination of time and planning across academic areas.

More recently, Bjork, Dunlosky, and Kornell (2013) discussed important beliefs and strategies for self-regulated learning and best practices to increase long-term retention and transfer. The authors reported, "that making errors is often an essential component of efficient learning." When students are faced with challenging curriculum and teachers ask for more than simple recall, it "tends to result in more errors being made

during the acquisition process, but it also tends to enhance long-term retention and transfer (e.g., Lee 2012, Simon & Bjork 2001, Taylor & Rohrer 2010)" (p. 435).

JUDGMENTS OF LEARNING

Metacognition can also play a critical role in successful transfer. Studies in science, mathematics, computer programming, and literacy have shown that helping students with monitoring and adapting learning strategies increased transfer (Bransford & Schwartz, 1999). Judgments of learning (JOLs) necessitate metacognitive skills because the student must make inferences based on their experience and beliefs, which in turn may contribute to decisions about studying and learning, but these JOLs have a complicated history.

Koriat (1997) defined *judgments of learning* as, "judgments made by participants at the end of a learning trial regarding the likelihood of remembering the acquired information" (p. 349). When students make predictions about their performance, many variables factor into that decision, "such as the sense of fluency in perceiving or recalling to-be-learned information" (Bjork et al., 2013, p. 438). However, factors unrelated to actual learning might cloud students' perceptions of their future abilities, and most secondary students have not practiced difficult metacognitive strategies. Teachers must aid students in this process multiple times before seeing improvement.

Even with practice, many studies have documented systematic errors in JOLs. One culprit for these errors is the stability bias explained by Kornell and Bjork (2009) as the action of believing one's memory will stay the same in the future. Participants in

many studies have incorrectly judged how much they will remember. Contrastingly, Koriat and Bjork (2005) described, "when participants provide aggregate judgments for the list as a whole, overconfidence is reduced, and there is sometimes under-confidence (Koriat et al., 2002; Mazzoni & Nelson, 1995)" (p.187). Students must take all of these factors into account when making JOLs.

Timing is also an important factor for accurate JOLs. Koriat and Bjork (2005) reported "T.O. Nelson and Dunlosky (1991) and Dunlosky and Nelson (1994; see also T. O. Nelson, Narens, & Dunlosky, 2004)…found that JOLs made at a delay following study are far more accurate in predicting eventual recall than are JOLs made immediately after study" (p. 188). This delayed effect highlights important strategies for teachers and students to keep in mind when predicting future success. Similarly, the speed at which a participant can answer a question can affect their JOL. Bjork et al. (2013) stated of the Benjamin et al. (1998) study, "The more confident participants were that they would recall an answer, the less likely they were to recall it" (p. 430). Participants felt more strongly about questions they answered quickly and gave higher JOLs, but because they spent less time thinking about them originally, they were more likely to forget. This complication, among the other interesting facets of JOLs, creates meaningful discourse around how individuals learn and how teachers can improve strategies to make learning more effective.

Chapter 3: Methods

Context

This study took place in a large public high school in a suburb of Austin, Texas. Because I teach at this particular high school, it is important to establish that no current students of mine were involved in the study. The study involved two content areas, English and Physics, and used district-created assessments focusing on a few major skills from the state's mandated curriculum, the Texas Essential Knowledge and Skills or TEKS.

Participants

The participants were high school students and teachers. There were 67 students with ages ranging from 15 to 19 (31 girls, 36 boys; mean age = 16.8 years, *SD* = 0.8 years). Students were 35.8% white, 25.4% Hispanic, 19.4% African American, 10.4% two or more races, and 9.0% Asian, and came from a variety of socioeconomic backgrounds. They were observed in one of their core classes: English II (n=31) or physics (n=36). Students participated in either class; no student was observed in both classes.

There were eight teachers (5 women, 3 men; mean age = 37.6 years, *SD*=10.9 years) with four teachers representing each core class. The teachers had an average of 11.2 years teaching experience (*SD*=9.4 years). Only one teacher had a second job outside of teaching. Students and teachers were not compensated for their participation.

Table 1. Sample Characteristics

	Students (n=67)	Teachers (n=8)
Sex (proportion female)	46.2%	62.5%
Age in years - mean	16.8	37.6
standard deviation	0.8	10.9
Race		
White	35.8%	75%
Hispanic	25.4%	12.5%
Black	19.4%	0%
Two or more races	10.4%	0%
Asian	9%	12.5%

MATERIALS, DESIGN, AND PROCEDURE

Participant Recruitment

To recruit participants, I visited teachers during common planning meetings to discuss the study and ask for volunteers. Once four teachers in each core area had volunteered and signed consent forms, I visited one of each teacher's on-level classes and outlined the requirements for participation, without detailing the variables I would be measuring. I excluded honors, special education, and English language learner classes to keep the classes as comparable to each other as possible in content and level. Students interested in volunteering were given an assent form to sign and a consent form for their parents to sign and asked to return them within two weeks.

Procedure

After two weeks of collecting forms, I visited each teacher's class and observed one class period (~90 minutes). I observed and audio recorded the lessons in order to note any significant interruptions or distractions (e.g., fire drill, significant behavioral issues) as well as to document student-teacher interactions and teaching styles. Immediately after the lesson concluded, but before students reported to their next classes, the students and teachers answered a questionnaire about their class experience. There is more information on the surveys in the measures section below. Individually, each teacher planned their lesson adhering to the following TEKS in whatever way they wanted, as long as all required TEKS were addressed. The English lessons focused on Media Literacy and covered the following TEKS:

> (11) Reading/Comprehension of Informational Text/Procedural Texts. Students understand how to glean and use information in procedural texts and documents. Students are expected to:
>
> (A) evaluate text for the clarity of its graphics and its visual appeal; and
>
> (B) synthesize information from multiple graphical sources to draw conclusions about the ideas presented (e.g., maps, charts, schematics).
>
> (12) Reading/Media Literacy. Students use comprehension skills to analyze how words, images, graphics, and sounds work together in various forms to impact meaning. Students will continue to apply earlier standards with greater depth in increasingly more complex texts. Students are expected to:
>
> (A) evaluate how messages presented in media reflect social and cultural views in ways different from traditional texts;
>
> (B) analyze how messages in media are conveyed through visual and sound techniques (e.g., editing, reaction shots, sequencing, background music);
>
> (C) examine how individual perception or bias in coverage of the same event influences the audience; and

(D) evaluate changes in formality and tone within the same medium for specific audiences and purposes.

The Physics lessons focused on thermodynamics and covered the following TEKS:

> (6) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:
> (E) describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms;
> (F) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and
> (G) analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy.

After a short break from the initial lesson (two to three class periods), a post-test was conducted in the normal classroom environment. There is more information on the post-test in the section below.

MEASURES

Teacher measures. The teacher survey included four major categories: teachers' positive affect, teachers' emotional expressivity, teachers' satisfaction with job and life, and class experience. All questions were rated on a five-point scale from (1) strongly disagree to (5) strongly agree. For the teachers' positive affect, I used Kunter et al.'s (2008, 2011) adapted teacher enthusiasm scale comprised of three items as presented in Keller et al. (2014). A sample item is, "I teach SUBJECT in this class with great enthusiasm" (Cronbach's $\alpha = .76$). For teachers' emotional expressivity, the Keller et al. (2014) adapted version of Gross and John's (1998) expressivity scale for use in the

teaching context was utilized. The scale had seven items (Cronbach's $\alpha = .83$). A sample item is, "When I'm feeling well during teaching it's easy for me to go from being in a good mood to being really joyful." The items for teachers' satisfaction and class experience were created by me and also applied a five-point scale from (1) strongly disagree to (5) strongly agree. A sample item for job satisfaction is, "I think teaching is right for me." A sample item for life satisfaction is, "I am excited to wake up every morning." A sample from class experience is, "Students were as attentive today as they usually are" (Cronbach's $\alpha = 0.64$ for job satisfaction, $\alpha = 0.28$ for life satisfaction, and $\alpha = 0.79$ for class experience). All survey measures can be found in Appendix A.

Student measures. Regardless of whether teachers think that they are teaching enthusiastically, the students' perceptions of their class experience and interactions with the teacher are important. Therefore, I corroborated the teacher scores by adding the students' perceptions of teacher enthusiasm, as well as observing the lessons conducted. By combining the different sources of data, I hoped to have a better sense of the teacher enthusiasm measure. Also, as I highlighted in the introduction, students can perceive having positive emotional expressivity as teacher enthusiasm, which is why I asked both through self-report from teachers and student reports. If only one of these accounts was examined, it could lead to inconclusive, one-sided results.

The student survey included five major categories: perceived teacher enthusiasm, interest, engagement, teacher-student relationship, and judgments of learning (JOLs). All questions were rated on a five-point scale from (1) strongly disagree to (5) strongly agree. The first two categories of questions are taken directly from Keller et al. (2014). The

three questions on perceived teacher enthusiasm came from Marsh and Bailey (1993)'s scale (Cronbach's $\alpha = .85$). A sample item is, "Our teacher in SUBJECT tries to inspire students about the subject." The questions on interest were a mixture of items from Nett, Goetz, and Hall (2011); Goetz, Pekrun, Hall, and Haag (2006); and items I created for this study. A sample item for interest (affective) is, "In SUBJECT class, I usually enjoy myself," and for interest (value) is, "Whatever grade I get, SUBJECT is very important to me" (Cronbach's $\alpha = .81$).

The last three categories (engagement, teacher-student relationship, and JOLs) include items that were created by me and also employ a five-point scale from (1) strongly disagree to (5) strongly agree. A sample item for engagement is, "I usually feel engaged in this SUBJECT." A sample item for teacher-student relationship is, "I think my teacher wants me to succeed." In an effort to examine if students' JOLs were related to their actual performance and teacher enthusiasm, I created items to measure this construct. A sample item is, "I feel like I know this material very well." (Cronbach's α = 0.84 for engagement, α = 0.85 for teacher-student relationship, and α = 0.77 for JOLs) All survey measures can be found in the Appendix.

Content area post-test. The second measure was a test of transfer in each of the domains. Each test had 10 multiple-choice questions and students had one class period to complete it. No students were pre-tested on the material, as the information had not been taught prior to the lesson. The items included in the analysis addressed the TEKS taught in the lesson I observed, as well as required the student to apply their knowledge and skills in a new context, a primary component of near transfer. Out of a possible ten

multiple-choice questions, this resulted in five questions on each content test. The questions eliminated from analysis were memory based questions, or simply tested skills not addressed in the lesson I observed. In order to increase comparability, the same test was given to all students within each content area. A sample item from the English test was, "The author of both 'Next Generation Classrooms' and 'Lego Lions' chose the photographs for both passages in order to--." A sample item from the physics test was, "A glass of water left in the sun becomes warm. A student adds ice to the water to make it cool. What energy change occurs when ice is added to the warm drink?" To maintain the integrity of tests still in use by the school district, most questions are not available for publication.

DATA ANALYSIS

To conduct my analyses, I first calculated means and standard deviations for each measure by averaging scores on items making up each measure (teacher's positive affect, teacher's life satisfaction, student's judgments of learning, etc.). I conducted *t*-tests to determine whether girls and boys, and white and non-white students differed.

Using each student's responses to the measures, I calculated correlations among all measured variables including the tests of transfer. I also calculated correlations between the teachers' responses to their measure and class averages of student perceived enthusiasm and class average of test scores.

Chapter 4: Results

I will present my results by first addressing descriptive statistics and then the analyses performed by research question. The final section presents results associated with two exploratory research questions.

Preliminary Analyses

In Table 2, I list descriptive statistics for the student measures including the means and standard deviations. Table 3 lists the means from the teacher measure by category. It is organized by self-rated enthusiasm score--low to high. I separated student groups based on gender and race (white/non-white) and tested for differences on all variables. Results showed no significant difference on any variable. Table 4 displays the results of those *t*-tests. There were also no significant differences on any variable when comparing students who had perfect scores on the test of transfer as compared to those who did not. Therefore, in all subsequent analyses I made no grouping distinctions. Correlations between all student measures and test scores are shown in Table 5.

Table 2. Means of the Student Measures

	Overall (n=67)		Girls (n=31)		Boys (n=36)		English (n=31)		Physics (n=36)	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Perceived Enthusiasm	3.9	0.9	3.9	1.0	4.1	0.9	4.3	0.6	3.8	1.1
Interest-Affect	3.4	1.2	3.2	1.3	3.5	1.1	3.7	0.9	3.0	1.3
Interest -Value	3.1	1.0	3.1	0.9	3.1	1.1	3.4	0.9	2.8	1.0
Engagement	3.4	1.0	3.4	1.1	3.5	0.9	3.7	0.8	3.2	1.1
Relationship with Teacher	3.9	0.9	3.8	1.0	4.0	0.8	4.3	0.6	3.6	1.0
Judgment of Learning	3.6	0.9	3.5	1.1	3.8	0.8	4.1	0.5	3.3	1.0
Test score	80%	0.20	79%	0.17	81%	0.17	85%	0.14	75%	0.19

Table 3. Means of the Teacher Measure

	Self Reported Enthusiasm	Positive Expressivity	Positive Affect	Job Satisfaction	Life Satisfaction	Class Experience	Class Average of Student Perceived Enthusiasm
A	3.62	3.57	3.67	3.67	3.50	2.75	3.22
B	3.67	4.00	3.33	3.00	4.00	2.75	3.89
C	4.21	3.43	5.00	3.00	2.50	3.75	4.56
D	4.21	3.43	5.00	5.00	5.00	3.75	2.79
E	4.31	4.29	4.33	3.67	3.00	4.00	4.27
F	4.71	4.43	5.00	3.33	4.50	4.75	4.67
G	4.71	4.43	5.00	4.33	3.50	5.00	4.11
H	4.86	4.71	5.00	3.33	3.00	4.25	4.69

Table 4. *t*-tests between Gender and Race

	Gender (n = 65)		Race (n = 65)	
	t	*p-value*	*t*	*p-value*
Perceived Enthusiasm	- 0.99	> 0.10	1.44	> 0.10
Interest-Affect	-1.12	> 0.10	1.08	> 0.10
Interest-Value	0.22	> 0.10	0.21	> 0.10
Engagement	-0.62	> 0.10	0.63	> 0.10
Relationship with Teacher	-0.85	> 0.10	0.74	> 0.10
Judgment of Learning	-1.44	> 0.10	0.68	> 0.10
Test of Transfer	-0.57	> 0.10	0.90	> 0.10

Table 5. Correlations of Student Measures

	Test of Transfer	Perceived Enthusiasm	Interest-Affect	Interest-Value	Engagement	Relationship with Teacher	Judgment of Learning
Test of Transfer	1						
Perceived Enthusiasm	-0.03	1					
Interest-Affect	-0.12	0.70**	1				
Interest- Value	-0.11	0.57**	0.61**	1			
Engagement	-0.15	0.70**	0.74**	0.63**	1		
Relationship with Teacher	0.07	0.65**	0.71**	0.57**	0.63**	1	
Judgment of Learning	0.13	0.68**	0.62**	0.64**	0.61**	0.73**	1

** Correlation is significant at the 0.01 level (2-tailed).

MAIN ANALYSES

To what extent are students' perceived teacher enthusiasm, student enjoyment, interest, engagement, and student reported relationship with the teacher related with each other?

My first hypothesis stated that there would be significant positive correlations between all affective variables measured on the student survey such as perceived enthusiasm, student interest-affect, student interest-value, and engagement, as has been presented in many other studies (Kunter et al., 2011; Keller et al., 2014; 2015) This hypothesis was confirmed. All variables had significant positive correlations with each other at the 0.01 level as seen in Table 5, confirming previous work on the relationship between these affective variables in the classroom environment and highlighting their important interactions.

To what extent are students' perceived teacher enthusiasm and near transfer related?

My second hypothesis addressed the relationship between perceived teacher enthusiasm and near transfer on an exam. Student performance on the near transfer tests was compared against teacher enthusiasm at both the individual level, and as a class average. I predicted students who perceived their teachers as enthusiastic would perform better on the delayed content test. This correlation proved not to be significant $r(65) = -0.03$, $p > 0.10$.

To what extent are students' perceived teacher enthusiasm and self-reported teacher enthusiasm related?

Because I observed eight teachers, I took the class average of each teacher's students' perceived enthusiasm scores and correlated these means with the self-report from the teachers. This correlation was examined to determine if students and teachers tended to rate the amount of enthusiasm similarly. I found an $r(8) = 0.6$, $p > 0.10$. Although a typically strong correlation, this was not significant perhaps because the sample size was only eight. Interestingly, there was one teacher who self reported fairly high enthusiasm, but his/her (I am leaving the pronoun indeterminate to ensure anonymity of the teacher) students perceived a much lower score of enthusiasm. When this teacher is eliminated from the correlation, the results increased to a positive significant relationship, $r(7) = 0.79$, $p < 0.05$.

To examine further possible differences between students within the highest self-rated and the lower self-rated teacher groups (four teachers in each), I conducted a *t*-test of mean differences. Results showed significant mean differences between these groups on all variables, including the test of transfer as seen in Table 6.

Table 6. *t*-tests between Self-rated Teacher Enthusiasm Groups (Low and High)

	n = 67	
	t	*p*-value
Perceived Enthusiasm	-5.75	0.00
Interest-Affect	-4.79	0.00
Interest-Value	-4.03	0.00
Engagement	-4.23	0.00
Relationship with Teacher	-3.95	0.00
Judgment of Learning	-3.82	0.00
Test of Transfer	2.07	0.04

To what extent can a student make an accurate judgment of learning when compared with actual performance on a test of near transfer?

Students' judgments of learning were also significantly, positively correlated with all of the other affective variables measured. However, it was not significantly correlated with the actual performance measure. There are several possibilities for this outcome outlined in the discussion section.

EXPLORATORY ANALYSES

To what extent are teachers accurately reporting their enthusiasm, and how does enthusiasm interact with other variables related to teaching?

I predicted teachers would report high levels of positive affect and positive emotional expressivity. As shown in Table 3 this hypothesis was confirmed because all teachers rated these variables at an average of 3.33 or higher on the 5-point scale. Interestingly, all physics teachers rated their positive affect toward the subject at the highest level (5.0) across all questions whereas only one English teacher did the same. Even though the physics students averaged lower on every measure, three of the four physics teachers reported levels of enthusiasm that placed them in the self-rated high enthusiasm group. Lastly, self-reported enthusiasm and class experience were positively significantly related, $r(8) = 0.94$, $p < 0.01$.

To what extent do the content areas English and physics differ on all the affective variables and actual performance on the measure of transfer?

The mean scores on *all* student measures were higher in English, as shown in Table 2. *t*-tests conducted showed significant differences for all variables as well, as shown in Table 7.

Table 7. *t*-tests between English and Physics Students

	n = 67	
	t	*p*-value
Perceived Enthusiasm	2.52	0.03
Interest-Affect	2.52	0.01
Interest-Value	2.73	0.01
Engagement	2.02	0.05
Relationship with Teacher	2.97	0.01
Judgment of Learning	4.26	0.00
Test of Transfer	2.38	0.02

Chapter 5: Discussion

General Discussion

Although the challenges of school-based research necessitate certain compromises, my study capitalized on many beneficial design factors. The required test of learning for both English II and physics was class-relevant and standardized. This benefitted comparability of scores and data analysis. Similarly the enthusiasm measures were adapted from notable studies of teacher enthusiasm. To add even more focus on near transfer to these measures I included questions about the class experience on the survey day, allowing students to reflect primarily on this occurrence and not an overall score of enthusiasm for the teacher. Lastly, by observing the lessons I was able to verify that specific TEKS related content was delivered to students. The following sections examine the research questions more deeply.

To what extent are students' perceived teacher enthusiasm and near transfer related?

Although student perceived teacher enthusiasm, student enjoyment, interest, engagement, and student reported relationship with the teacher were all significantly correlated with each other (see Table 5), none of these variables resulted in a significant correlation with the test of near transfer. There are many factors at work in this scenario including entering knowledge of students and teachers, previous learning experiences, and individual differences. Within this study, I had a limited sample of both students and teachers. I expect if the survey were administered to a larger group it could show more significant results.

One main possibility for this non-correlation is that teachers are aware of the level of engagement and ability of their students. If a majority of students are having a hard time with a subject, and historically tend to perform poorly on an exam, the teacher may try to overcompensate with expressing enthusiasm in order to help the students respond with more engagement and perform better. Contrastingly, if a class averaged well on most assessments and tended to grasp material quickly, the teacher might not feel the need to express enthusiasm when teaching because it requires extra energy and effort when the end results might stay the same. This would result in a low or non-correlation as well.

The content test in both English and physics were created by the school district's curriculum specialists based on the mandated TEKS. These test results are reported to the district as a benchmark analysis of student progress. This led to equality of assessment across the different classes I observed, but perhaps some teachers focused more heavily on the desired results of this assessment than others. On the other hand, teachers who were perceived with high enthusiasm might have done the opposite and not taught to the test. Both of these scenarios could affect the correlation.

Overall these results continue to support the idea in education literature that teachers are not simply conduits of information. Teachers and students have a very delicate relationship that can be infinitely altered and transformed over time and the classroom environment contains an elaborate reciprocal system between these two groups of people.

To what extent are students' perceived teacher enthusiasm and self-reported teacher enthusiasm related?

My findings echoed Keller et al. 2014, in that "students perceived their teachers to be highly enthusiastic and reported moderate to high levels of interest," but not that, "students' perceived teacher enthusiasm also had a moderately strong correlation with teachers' self-reports of positive affect and positive emotional expressivity" (p. 33). As discussed in the results section, this correlation was high at 0.60, but because of limited sample size, was not significant. When the teacher whose self-reported enthusiasm was contradicted by the students' rated teacher enthusiasm scores (Teacher D) was removed from the analysis, the correlation becomes significant and if a greater number of teachers had been observed, findings would likely confirm what Keller et al. 2014 found.

To what extent can a student make an accurate judgment of learning when compared with actual performance on a test of near transfer?

Because the judgment of learning was not significantly correlated with student performance, it leads me to believe that these affective variables can influence a student's confidence about learning material, even if performance does not necessarily reflect mastery. Positive emotions experienced in class could have led a student to believe he/she understood the lesson taught, when in fact he/she did not fully grasp it. Although this demonstrates an important dynamic within the classroom, it could also be troubling if students continue to feel confident without reaching mastery.

To what extent are teachers accurately reporting their enthusiasm, and how does enthusiasm interact with other variables related to teaching?

All teachers in this study reported moderate to high levels of enthusiasm, but *every* physics teacher rated his or her positive affect component of enthusiasm at the highest level. Further investigation is required to determine the source of this higher self-rated enthusiasm in the science teachers.

Parallel to what Kunter et al (2011) reported, I found no significant correlation between job and life satisfaction with self-rated enthusiasm in teachers, $r(8) = 0.14$, $p > 0.10$, and $r(8) = -0.08$, $p > 0.10$, respectively. This seems plausible when thinking about teacher commitment and its relationship to enthusiasm and overall satisfaction. Teacher commitment can be defined as "their identification with their school (organizational commitment) or their profession (professional commitment; Chan, Lau, Nie, Lim, & Hogan, 2008; Firestone & Pennell, 1993)" (Kunter et al. 2011, p. 291). Other factors have been found to contribute to teacher commitment such as receiving feedback, experiencing autonomy, and having sufficient resources and ample learning opportunities (Firestone & Pennell, 1993). Thus, it makes sense to examine all factors of a teacher's experience to determine how a school might help support teachers and in turn encourage job and life satisfaction.

To what extent do the content areas of English and Physics differ on all the variables and transfer?

Although the distinction between English and physics was not my primary interest, it does highlight a noteworthy aspect of how content area and classroom experience are related. There are many different explanations for student measures in English averaging higher in all areas than physics. English at the secondary level can connect students to their teachers in a different way than other core areas. Students often have to write about themselves, and teachers will share more things personal in nature to relate to their students during English class. This could mean students felt more positively about their English teacher as a person, and possibly wanted to rate them and their experience higher on the survey, regardless of their true feelings.

Another mediating factor might be the teachers' interest in this particular unit of study. Hypothetically the English teachers may enjoy media literacy and spent more time finding examples to use in class that would be engaging than the physics teachers who may have been more interested in other units and not thermodynamics. Further questioning of the teachers might shed light on these conjectures. Because I am only looking at two core classes, English II and physics in this study, both of which are required courses for students in Texas, I expected to find varying levels of interest and background knowledge from both students and teachers. So, these required courses might elicit more neutral or negative emotions and this would of course vary across other classes and other schools. Further studies should examine different core areas to account for these differences.

LIMITATIONS

Other studies similar to this have utilized much larger-scale surveys. Because this study focused on both the class experience and specific learning outcomes (mastery of the TEKS), a smaller sample was required, yet it was also the primary limitation of this study. A large sample of both teachers and students would allow for more accurate analyses and results because more variance within students and across the teachers would be included. In fact, the percentages of participating students ranged from 25% to 80% within each class. This inconsistency caused unequal representation across teachers.

Similarly, the students who returned their parental forms could be the better students on average and/or like their teacher more, which would inherently create a biased sample. However to mitigate these limitations, I averaged student perceptions of enthusiasm and all other measures, as well as attempted to recruit students equally. The multimethod approach combining observations with student and teacher self-reports also supplemented this study's credibility even in such a limited sample size. Lastly, the English II teachers were all women and three of the four physics teachers were men. This gender difference did not affect the results, but in future research, more gender balance in teachers might be important to examine.

IMPLICATIONS FOR FUTURE RESEARCH AND PRACTICE

This research does not suggest that demonstrating enthusiasm is a requirement for good teaching, nor that simply because no correlation was found between student perceived enthusiasm and test of transfer that teacher enthusiasm cannot help students to

become and stay engaged and to learn more content. Keller et al. (2014) said, "In her theoretical model, Frenzel (in press) creates an argument for students' motivation as one antecedent for teacher affect and emotions" (p.35). Thus, it is naïve to assume that teacher enthusiasm can occur and persist unless the conditions are ripe for it. There is even the possibility that a teacher may be a naturally enthusiastic person, but because of other life-stressors on this day or this year, did not teach in a way that his/her students perceived as enthusiastic. Feldon (2007) discussed the idea of cognitive load for teachers; depending on experience, teachers may feel more comfortable with the requirements for a unit of study and thus be able to share more of their personality and be more enthusiastic.

To continue this research, I would add more measures of transfer along the way, perhaps examining all major unit tests throughout the year and periodical surveys of enthusiasm measures. It would also be interesting to compare enthusiasm measures to low-stakes assessments within the classroom. The research on teacher enthusiasm still requires further investigations because, although we are much closer to an operational definition than we were before, the effects can be observed in numerous domains of learning, emotion, and motivation and we should try to find more direct links. Rarely have studies examined content-related mastery, like transfer, with respect to teacher enthusiasm, so this research should lead others to pursue specific learning outcomes. Lastly, to continue this line of research I would expand the observations and surveys to multiple content areas. When beginning my research, fewer studies on secondary English and science were available than mathematics or elective courses. Expanding to various subjects might introduce interesting subject-specific distinctions.

Appendix

Item wording of scales

Teacher's questionnaire

Teachers' positive affect.

PosAff1	I teach SUBJECT in this class with great enthusiasm.
PosAff2	I always enjoy having taught students new things.
PosAff3	I really enjoy teaching SUBJECT in this class.

Teachers' positive emotional expressivity.

PosExp1	When I'm happy in class, my feelings show.
PosExp2	During teaching I laugh a lot.
PosExp3	When I'm feeling well during teaching it's easy for me to go from being in a good mood to being really joyful.
PosExp4	I laugh out loud when my students tell me a joke that I think is funny.
PosExp5	During teaching I often laugh so hard that my eyes water or my sides ache.
PosExp6	In class my laugh is soft and subdued (R).
PosExp7	Whenever I feel positive emotions during teaching, my students can easily see exactly what I am feeling.

Teacher's satisfaction

Job Satisfaction

JobSat1	I am happy with all aspects of my job (requirements, pay, resources, etc.)
JobSat2	I think teaching is right for me.
JobSat3	I do not feel like I experience burnout when teaching.

Life Satisfaction

LifeSat1	I am excited to wake up every morning.
Life Sat2	I am exactly where I want to be when it comes to my life.

Class experience

ClassExp1	I presented the information as clearly as possible
ClassExp2	On average, my students are very attentive in class.
ClassExp3	Students were as attentive today as they usually are.
ClassExp4	Class felt normal for me today.

Students questionnaire

Students' perceived teacher enthusiasm.

PercEnth01	Our teacher in SUBJECT teaches with enthusiasm.
PercEnth02	Our teacher in SUBJECT enjoys teaching.
PercEnth03	Our teacher in SUBJECT tries to inspire students about the subject.

Students' interest.

Affective component

Enj1	In SUBJECT class, I usually enjoy myself.
Enj2	Today in class I really enjoyed myself.

Value component

IntrVal01	Whatever grade I get, SUBJECT is very important to me.
IntrVal02	I find the subject SUBJECT very important.
IntrVal03	SUBJECT is my favorite subject.

Students' engagement

Engage	I usually feel engaged in this class.
Engage	I have a hard time paying attention in this class. (R)
Engage	I felt engaged by everything my teacher discussed in class.

Students' relationship with teacher

Relate1	I feel very comfortable talking one-on-one with my teacher.
Relate2	I think my teacher wants me to succeed.
Relate3	My teacher thinks I am smart.

Students' judgment of learning

JOL1	I feel like I know this material very well.
JOL2	I usually grasp material after the first time I am introduced to it.
JOL3	I felt like the material was presented clearly by my teacher.

Note. (R) = reverse coded

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